FLIGHT

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1931

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Mar. 28. Rugby Football: R.A.F. v. Army, at Twickenham, 3 p.m.
Mar. 31. "Injection, Ignition and Combustion in High-Speed, Heavy-Oil Engines." Lecture, by Dr. S. J. Davies and E. Giffen, before R.Ae.S.
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Sept. 26. Garden Party, Bristol and Wessex Ae.C.

EDITORIAL COMMENT

THE Roman Empire depended for its existence largely upon its roads. Wherever the legions established themselves, the road engineers at once got to work and drove forward those wonderful straight roads, many of which survive in Great Britain to astonish and delight the modern motorist. Watling Street, Ermine Street, Fosse Way, and others still survive in whole or in part, though it is sometimes hard for the unlearned citizen to recognise sections of them under their modern names. The fine modern section of Watling Street between Rochester and Dartford is well known by its ancient name; and the name survives again when the road has passed beyond Edgware and heads off for St. Albans. But many Cockneys would be surprised if they were told that the Old Kent Road and the Edgware Road are really sections of the old Watling Street.

India and Burma

Who paid for those roads? Was the money provided by the local revenues of the province of Britannia, or did the Imperial exchequer contribute towards the funds? Historians may know, but we have no precise information. We know that the Roman Empire was, in theory, an autocracy ruled by Cæsar, but practically administered by a very efficient civil service. The policy of road making was recognised everywhere as a condition of existence for the Empire, and was everywhere pursued, wherever the money came from. We recall no instance of a provincial governor neglecting this policy on the plea of lack of funds. A governor might as well have disbanded his legions. In such matters as communications, an autocratic Empire is in a very fortunate position. Uniformity of policy can be insisted upon.

We are coming to recognise that airways must be to the British Empire much what roads were to the Roman Empire. But we cannot frame one uniform policy for the whole Empire. We are hampered by its constitution. The British Empire is not one unit under an autocratic Government, but a Commonwealth of nations. Each unit controls its own

finances and its own policy. It decides where it wants an airway, and, if so, whether it can afford to pay for one. A promising scheme of aerial transport may be held up by the poverty of a local government. Had there been such a thing as a common fund for Empire air communications, we might long ago have started an airway from British Guiana along the crescent of the West Indian islands to the Bahamas, with branches to Jamaica and British Honduras. The Home Government could not afford to finance such a scheme, desirable though it certainly appears to be, and the local governments in the West Indies could only offer insufficient subsidies. In the Africa airway, now in process of being established, we have a fine example of Imperial co-operation. The scheme has behind it two first-class governments, those of Great Britain and of South Africa, while the intermediate colonial governments contribute according to their means, and so get a great boon at an economical rate. But such co-operation is not always to be found.

The latest example of an airway scheme being postponed through the political conditions of the British Empire was revealed the other day in the House of Commons by Mr. Montague. He said that the Government of India had abandoned its intention of carrying the Eastern airway beyond Calcutta in view of the probable coming separation of Burma from India. It will be remembered that the intention had been that the Indian Government should extend its State airway this year from Delhi to Calcutta, and then, as soon as possible, carry it on to Rangoon. Then came the Simon report and the Round Table Conference, from which it appears that Burma is to be politically separated from the Indian Empire. We are not concerned with the wisdom or otherwise of this proposed rearrangement. There is little enough in common between a Pathan from the North West Frontier and a Tamil Pariah from Madras, and there seems no typical Indian from whom the Burman is to be distinguished. In fact, the Burman is racially akin to most of the inhabitants of the Himalayan mountains, who are always reckoned as simply Indians. We seem to remember that Burma's claim to separation in the past was based on financial, rather than on national, grounds. At one time, and perhaps the condition persists, the Burman budget regularly used to show a surplus, and the Province thought it would be nice to keep that surplus for its own uses, instead of having to make a contribution to the common revenues of India. If a deficit had become a usual event, we may feel sure that the Simon Commission would not have heard much about Burma's desire for a separate political existence.

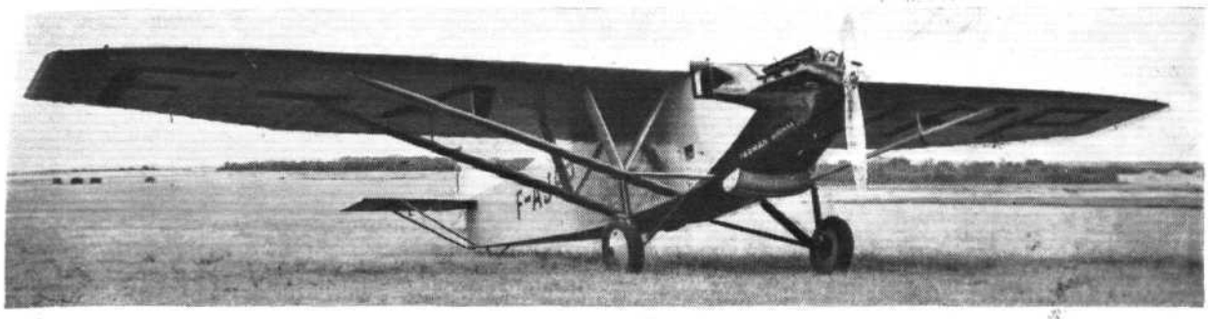
So, if Burma is soon to be a separate entity, it is inevitable that the Indian Government should drop its plans for starting an airway from Calcutta to Rangoon. This will probably mean delay in getting that bit of the Eastern airway going, which is unfortunate. A new colonial government cannot be set up in a day, and if the change is to wait upon a general agreement as to the future constitution of India, the delay may become serious from the air communications point of view. On the other hand, the prospect of dealing with a Government of Burma rather than with the Indian Government is attractive. We may take it that the new Government will have money to spend on developing its own country, and that the interests of the great port of Rangoon will be far nearer to the heart of the Government of Burma than they could ever be to the heart of the Indian Government. Rangoon is a very important centre, and its communications with London have been—in fact, are—extremely inadequate. Considering its actual distance from London as the aeroplane flies, there is no great city in the Empire whose need for better communications is greater. It is only natural to suppose that an improvement of those communications will be one of the first matters with which the new Government of Burma will concern itself. Air transport may congratulate itself on that prospect.

We imagine, too, that sentiment in Burma will not raise the same difficulties as have arisen through the nationalist sentiment in India. Mr. Montague explained that in India it would be out of the question to give an air mail contract to any company which was not registered in India with a rupee capital, and with a majority of Indian directors on the board. That being so, a State airway is, perhaps, the best thing that we can hope for. There is also a nationalist sentiment in Burma, but we very much doubt if it is so strong as to prefer an absence of rapid transport to transport provided by a British company. That, however, remains to be seen. Burman nationalism is inspired, we understand, by a much stronger resentment of Indian enterprise than of British enterprise. In fact, Imperial Airways may find a Government of Burma much more easy to deal with than the Indian Government has been found to be.

From another point of view the prospect of dealing with a Government which has funds in hand is pleasing. The service from Calcutta to Rangoon certainly ought to be run with flying boats, not with landplanes. This fact is not disputed, but at times the Indian Government, when considering this service, has talked about the higher cost of flying boats, and pleaded that it could only afford to start the service with landplanes. We hope that no more will be heard of this. It is a very great mistake to start a service with a class of aircraft which is not the right one for the special circumstances of the route. If the Government of Burma will decide to have only the right class, namely, flying boats, it will be doing the best for its own interests. Even some delay in starting the service may be well worth while if in the end the service is started in the best possible way.

Another Office for Colonel Shelmerdine

BEFORE a very cheerful and enthusiastic gathering, Lieut.-Colonel Shelmerdine was last night officially inaugurated with due ceremony as the first honorary president of the Junior Aero Club, which has been formed in the Ham Bone Club, Ham Yard, Great Windmill Street, W.1. The occasion was marked by a flying dinner at which a large number of well-known people in aviation were present. Mr. Handley Page, with one of his typical speeches, introduced Colonel Shelmerdine as the guest of the evening, after which Captain Teesdale, secretary of the club, presented Colonel Shelmerdine with the freedom of the club and his chain of office as president. Thereafter followed a ceremony for several new members, and both Mr. Handley Page and Commander Harold Perrin found that their powers of flight were very inefficient, presumably owing to the absence of slots, anyway they both crashed.



TWO NEW RECORDS

Duration and Distance (Closed Circuit) by Lalouette and Reginensi

FLYING a large Farman monoplane, type 302, equipped with a 650-h.p. Hispano-Suiza water cooled motor, fitted with a reduction gear, and carrying 2,000 kg. (4,410 lb.) of load, the French airmen, Marcel Lalouette and Georges Reginensi took off from Le Bourget at 3.20 o'clock Monday afternoon, March 10 last, in an attempt to establish new records for a plane carrying the above mentioned load. They traversed the circuit Le Bourget-Chartres-Etampes in a continuous flight and landed at Le Bourget the following morning at 9.15 o'clock having remained in the air for 17 hr. 4 min. and covered 2,678 km. (1,664 miles) at an average speed of 158 km. (98 miles) per hour. Two new records, a duration and a long distance one over a closed circuit, for a 'plane carrying 2,000 kg. (4,410 lb.) of load were thus established.

The previous duration record was made by the German pilot Ristics at Dessau, June 24, 1927, who remained in the air 13 hr. 1 min., while the long distance record over a closed circuit for a 'plane carrying this load was held by the German airman Steindorf, who covered 1,750 km. (1,087 miles) at Dessau, July 31, 1927. The long distance record was thus beaten by 928 km. (576·6 miles) and the duration record by more than 4 hr. A new speed record for planes transporting 2,000 kg. (4,410 lb.) of load over a course of 2,000 km. (1,242·8 miles) was also established.

Both Laloutte and Reginensi are veteran airmen, having taken part in several long distance flights the past year. As pilot for Captain Goulette, Lalouette recently made the flight Paris-Saigon and return, and only last month in company with the young aviator, de Permangle, he established a new long distance continuous flight record for light planes, flying from Istres to Dakar, West Africa, in a Farman two-seater monoplane equipped with a Renault 100-h.p. motor. Reginensi is also a well known pilot. A former chief petty officer in the 34th Aviation Regiment at Le Bourget he last year made the first flights accomplished between Paris-Saigon and Paris-Madagascar in company with Andre Bailly, the well-known French sportsman.

The Farman monomotor monoplane 302, used by Lalouette and Reginensi in the above flight, is a converted type of the Farman tri-motor (230 h.p. each) machine, the passenger 'plane known as the "Silver Star" which is in daily operation on the Paris-Berlin and the Paris-Copenhagen lines. The fuselage is constructed of wood and is covered with ply-wood. The wings are also of wooden construction and are attached to the upper part of the fuselage and braced by oblique struts constructed of duralumin well streamlined, two on each side and attached to the lower part of the fuselage. The landing gear is of the split axle type having a width of 3·30 m. (10 ft. 8 in.) between the wheels. It is equipped with shock absorbers of the Messier type and braced by struts, two of which are fastened to the wings, on each side of the fuselage, and two to the under side of the fuselage itself.

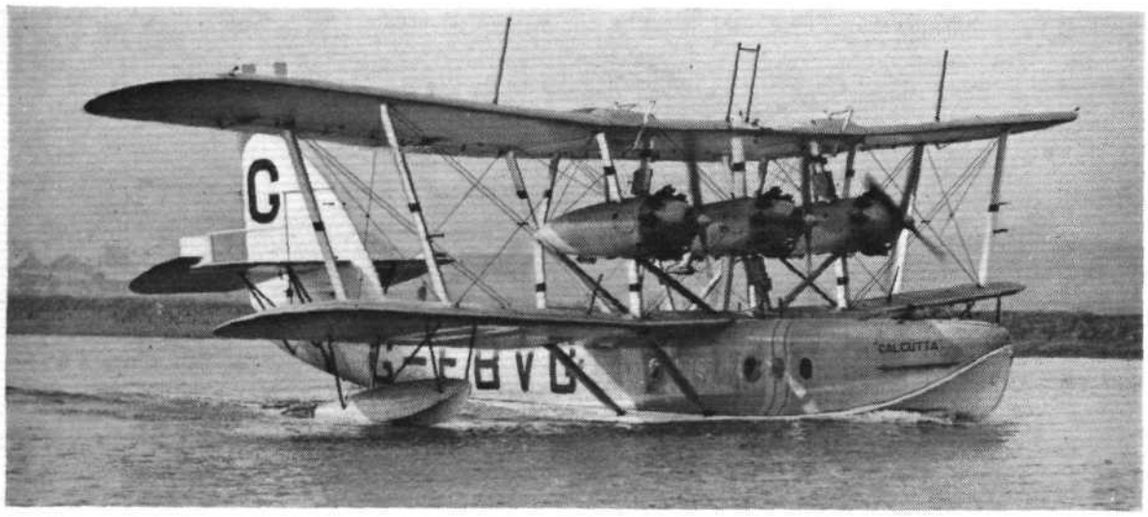
The fuel tanks, which are installed in the fuselage have a maximum capacity of 7,000 litres (1,556 gallons), but only 2,600 litres (580 gallons) of petrol and 200 litres (44 gallons) of oil were, however, carried by Lalouette and Reginensi at their take off for this flight.

The Hispano-Suiza motor installed on this plane is a 650 h.p. water-cooled 12-cylinder "V" (60°) 2,000 r.p.m. engine, fitted with a reduction gear. It has a bore of 150 mm. (6 in.) and a stroke of 170 mm. (6·8 in. approx.) with a compression of 6·2. The total weight empty is 469 kg. (1,032 lb.), the fuel consumption is 222 grams per h.p./hr., and the oil consumption 5·5 grams per h.p./hr. This engine develops a maximum power of 754 h.p. at 2,000 r.p.m. It is the type used by Costes and Bellonte in their transatlantic flight Paris-New York last autumn.

The principal characteristics of the Farman 302 are as follows: Span, 19·08 m. (62 ft. 6 in.); length, 13·35 m. (43 ft. 9 in.); height, 3·20 m. (10 ft. 5 in.); wing surface, 66 sq. m. (710 sq. ft.); weight empty (fully equipped), 2,730 kg. (6,019 lb.).

R. C. W.

The Farman 302 monoplane, powered with a 650 h.p. Hispano-Suiza engine, used by Laloutte and Reginensi in their record flight, is shown here and at the top of this page.



SERVICE

Launched on February 20, 1928, the first of the Short "Calcuttas" has now completed three years of flying, and has in that period completed 1,160 hours of flying and covered 104,400 miles. The machine is still in excellent condition.

WHEN British flying-boat firms first began to build all-duralumin flying-boats there was little or no knowledge available concerning the likely life of a machine so built. Corrosion was something of a bugbear, and although experiments had indicated that the anodic treatment might reduce corrosion risk quite considerably, there was still some uncertainty about its effectiveness under actual operating conditions. Much would also depend upon the care taken by the operating company in inspecting the machine frequently, and in washing down with fresh water any part which had been scratched. We think that in this connection it is worth while reminding our readers that as long ago as 1926, in the first number of THE AIRCRAFT ENGINEER (Technical Supplement to FLIGHT), Mr. Oswald Short pointed out that no single word had done more to delay the adoption of metal construction than "Corrosion," and that this was due chiefly to a failure to grasp the fundamental fact that "corrosion" was merely another word for "rust." With his usual foresight Mr. Short realised that if we could only come to regard corrosion in the same way as we regard rust, it would lose much of its terror. Mr. Short has had the courage of his convictions, and he is now reaping the reward of his faith in metal construction.

The first Short "Calcutta," G-EBVG, made its first flight on February 20, 1928, and has been in service with Imperial Airways, Limited, for more than two years, first on the route from Genoa to Alexandria, and later on the route from Athens to Alexandria. During that period the machine has flown for 1,160 hours, and has covered a distance of 104,400 miles. The machine is now about to come off the service for its annual overhaul, and it is worthy of note that apparently it is in excellent condition. Not only is the metal hull itself still thoroughly sound, but the wing covering, doped with "Cellon," is also in very good condition.

G-EBVG has never been in a hangar since it left this country, and for more than two years the machine has, when not flying, been moored out day and night, subject to extremes of temperature and widely-varying weather conditions. There is every reason to believe that G-EBVG is good for several years to come. The Short "Calcuttas," it will be recollected, are fitted with three Bristol "Jupiter" engines.

THE SCHNEIDER TROPHY

High Speed Flight Selected

THE Air Ministry announces that the following pilots have been selected to commence special high-speed flying training after Easter :—

Flight-Lieutenant E. J. L. Hope, A.F.C.
Flight-Lieutenant F. W. Long.
Flight-Lieutenant J. N. Boothman.
Flight-Lieutenant G. H. Stainforth.
Lieutenant G. L. Brinton, R.N. (Flying Officer, R.A.F.).
Flying Officer H. H. Leech.
Flying Officer L. S. Snaith.

From these officers the final team of three will be selected to represent Great Britain in the Schneider Trophy contest. Squadron-Leader A. H. Orlebar, A.F.C., will be in administrative command. Flight-Lieutenant W. F. Dry has been selected as the Engineer Officer. Flying Officer M. F. Tomkins will be the Stores Officer.

This team of seven flying members, apart from three officers concerned with administration and equipment, is surprising on account of its size. The teams of 1927 and 1929 consisted only of a C.O., an engineer officer, and four flying members. This team of seven comprises one member of the 1929 team, three officers who have been practising for the past year on high-speed aircraft at Felixstowe, and three new members, about whose qualifications very little is generally known.

Stainforth, of course, was in the 1929 team. That he did not fly in the race was not due to any inferiority in his skill to that of Waghorn and the rest. Stainforth was reckoned by the experts as good as our best; but he had devoted himself to the Gloster Napier 6, and had never flown the Supermarine Rolls Royce S6 at all. As his machine could not race, neither could Stainforth. But he put up a world's record on it which stood for about half an hour, until it was beaten by Orlebar. We are very glad that Stainforth is to have another chance.

For the past year there has been no official High-Speed Flight, but Boothman was at Felixstowe for the express purpose of flying the racing seaplanes for experimental purposes. Unofficially, Long and Linton Hope have also gained experience of flying these machines, and it is only reasonable to put these three officers into the Schneider team. Linton Hope was one of the pilots who went with Wing Commander Pulford on the first Cairo-Capetown flight on Fairey 3D machines in 1926.

Brinton, Leech, and Snaith are the actual new-comers. Snaith has become known to some extent by some fine demonstration flying of Comper "Swifts" and "Avians." He has lately been a test pilot at South Farnborough. Leech has been at Felixstowe. Brinton comes from the Fleet Air Arm, and is actually a naval officer with temporary rank in the R.A.F. This is the first occasion on which an

officer in this position has been appointed to R.A.F. work more than that on aircraft carriers. The Fleet Air Arm works with ship 'planes with wheels, not with seaplanes, but still a naval officer may be expected to know a lot about handling craft on the water. We have no doubt that Brinton has also shown himself to be above the average when in the air, and his chance of flying one of the machines in the contest will depend entirely on his merit as a seaplane pilot. From among these seven, we certainly ought to find three pilots as good as any who have flown for Great Britain in the past.

The Date and the Course

The Royal Aero Club announced, on Monday, 23rd, that the Schneider Contest will be held on Saturday, September 12, over the Solent and Spithead. It was added that "The Royal Aero Club has given the fullest consideration to the claims of other localities but, after careful review of the facilities available, and the prevailing conditions at each place, has decided that the Solent and Spithead provides the most suitable stretch of water for the safe and efficient conduct of the contest."

The detailed course has yet to be decided.

RE-EQUIPPING R.A.F. SQUADRONS

The "Fury," the "Gordon" and the "Hart Fighter"

THE following is the programme for re-equipping squadrons of the Royal Air Force in the first two quarters of the present year. In the first quarter the squadrons to receive new types of aeroplanes are as follows :—

No. 28 (Army Co-operation) Squadron (Ambala) or No. 31 (Army Co-operation) Squadron (Quetta), Wapiti for Bristol Fighter (re-equipment to be commenced).

No. 111 (Fighter) Squadron (Hornchurch), Bulldog for Siskin.

No. 501 (City of Bristol) (Bomber) Squadron, Wapiti for D.H.9.A. (re-equipment completed).

No. 203 (Flying Boat) Squadron (Basra), Rangoon for Southampton (re-equipment completed).

No. 10 (Bomber) Squadron (Upper Heyford), Hinaidi for Hyderabad (re-equipment to be commenced).

For the April-June quarter the programme is as follows :—

No. 23 (Fighter) Squadron (Kenley), 1 Flight with Hart Fighter for Gamecock.

No. 43 (Fighter) Squadron (Tangmere), Fury for Siskin.

No. 40 (Bomber) Squadron (new squadron), to be equipped with the Fairey Gordon with Panther 2A engine.

No. 28 (Army Co-operation) Squadron, or No. 31 (Army Co-operation) Squadron, Re-equipment with Wapiti to be completed ; Re-equipment of the other with Wapiti to be commenced.

The above list is full of interest. We heartily congratulate that very fine squadron, No. 43 F.S., whose performance with wing tips looped together at Hendon and Croydon last summer aroused universal admiration, on being selected for the first issue of Hawker "Fury" interceptor fighters. The squadron has won this distinction on its merits ; but it is also interesting to note that the "Fury" will in the first instance go to Tangmere, one of the coast aerodromes. Whether tactical considerations have influenced the selection of the first squadron to receive the interceptor, we cannot at present say ; but it will be interesting to see whether the next Air Exercises show that a coast aerodrome is the right place for the interceptor or not. Squadron Leader Slatter will have quite as interesting and busy a summer this year as he had in 1927, when he commanded the Schneider team.

A very interesting experiment (for we suppose that it cannot be called anything else at the moment) is the re-appearance in the R.A.F. of a two-seater fighter. One flight of No. 23 F.S. is to receive the "Hart Fighter," doubtless with the idea of trying out thoroughly whether a two-seater fits in with modern ideas of fighting tactics. In the Fleet Air Arm, the "Osprey," which is another version of the "Hart," is being introduced as a Reconnaissance Fighter. No. 23 F.S. is to be congratulated on having been selected to make this very interesting experiment. It is the only squadron which still has the "Gamecock" ; and though that machine has always been popular with fighter pilots, it is certainly an obsolescent type.

Another innovation is giving the "Wapiti" to two army co-operation squadrons in India. Hitherto the standard A.C. machine has been the "Atlas," but these two squadrons have had to carry on with the old "Bristol Fighter." Overseas the "Wapiti" has been a general purpose machine, and so far has only been handed out to bomber squadrons. Now we see army co-operation squadrons also getting it. It will undoubtedly serve the purpose very well. All the four bomber squadrons in India already use the "Wapiti" and now the army co-operation squadrons are getting the same type. It is well fulfilling its title of a general-purpose machine, and it will be a great advantage for the stores branch in India to have to deal only with one type.

Another item in the programme of considerable interest is that a new squadron, No. 40 B.S. is to start its career with what is partially a new type, namely the "Gordon." This is a Fairey 3F machine with Panther 2A engine. The air-cooled engine will look strange at first in the nose of the familiar "3F," but it is performance which matters.

One more squadron gets the "Bulldog," namely, No. 111 F.S. We confess that we should like to see the replacement of "Siskins" proceeding at a more rapid pace, but a good beginning has been made in this programme, and we look forward to the publication of subsequent replacement programmes with more than a little interest.

At St. James's Palace

AT the Levée held by His Majesty the King at St. James's Palace, on March 24, the following were present : Air Marshal Sir E. Ellington, Principal Air Aide-de-Camp, Group Captain L. W. B. Rees, Wing-Commander Louis Greig, and the Rt. Hon. Lord Amulree, Secretary of State or Air. Amongst those presented to His Majesty the King were :—Flight-Lieut. J. Addams, Flight-Lieut. J. Armour, Flight-Lieut. D. Bett, Flying Officer V. Bowling, Flight-Lieut. D. Boyle, Flying Officer G. Buxton, Wing-Commander F. Cowtan, Sqdn.-Leader J. D'Albiac, D.S.O., Sqdn.-Leader A. Ellerton, O.B.E., Sqdn.-Leader O. Gayford, D.F.C., Group Capt. L. Gordon, D.F.C., Wing-Commander A. Gregory, M.B.E., M.C., Wing-Commander W. Hargrave, O.B.E., Flight-Lieut. G. Hayes, Flying Officer F. E. Hayter, Flying Officer H. Hayter, Air Vice-Marshal F. Holt, C.M.G., D.S.O., Wing-Commander B. Huskisson, D.S.C., Sqdn.-Leader H. James, O.B.E., Flying Officer G. Klein, Flying Officer J. Markby, Air Commodore J. McIntyre, M.C., Group Capt. A. Miley, O.B.E., Wing-Commander E. Norton, D.S.C., Flight-Lieut. H. Nowell, Flying Officer H. Piper, Flight-Lieut. J. Ryde, Flying Officer V. Smuth, Sqdn.-Leader C. Stevens, M.C., Group Capt. B. Sutton, D.S.O., O.B.E., M.C., Flight.-Lieut. R. Waite, Sqdn.-Leader F. Wilkins, etc.

U.S. Airman Adrift for Four Days

AN American pilot, Mr. Harshman, was picked up on March 22 by the Hamburg-Amerika ss. *Cerigo*, adrift in a rubber boat in the Pacific, and brought into Buenaventura, Colombia. He stated that he was forced down on March 17 by exhaustion of his petrol. After a while his machine sank, and he remained four days afloat in the rubber boat—worried by sharks—before he was sighted and picked up.

Revised S.M.A.E. Competition Rules.

IN our issue of March 13, we published the revised general competition rules issued by the Society of Model Aeronautical Engineers, in which a formula for fuselage models was given. We are requested to point out that this was incorrect and should read as follows : Minimum value of maximum cross-sectional area =

$$\left(\frac{\text{overall length of body}}{10}\right)^2$$

T.M.A.C. Meeting

THE inaugural meeting of the 2nd Wing (Nos. 4, 5 and 6 Squadrons) of The Model Aeroplane Club will be held at Parliament Hill on Sunday, March 29, at 11 a.m.

CYLINDER GRINDING EXTRAORDINARY

The "Hutto" Cylinder Grinder is of very simple construction, and yet, even in relatively unskilled hands, it enables cylinder bores of car engines to be ground with considerable accuracy. For aero engine work this grinder has also been used with considerable success.

ON March 20 a demonstration was given at the Duke's Street, St. Pancras, works of Harvey Frost and Co., Ltd., of the "Hutto" cylinder grinding machine, an invention of American origin which has become very popular in the United States, and which has already become fairly well known in Great Britain. The demonstration given by the Harvey Frost firm was intended chiefly to interest those who are connected with automobile repair shops, more particularly the smaller ones, in which the particular model shown should find ready application due to its simplicity, cheapness and "foolproofness."

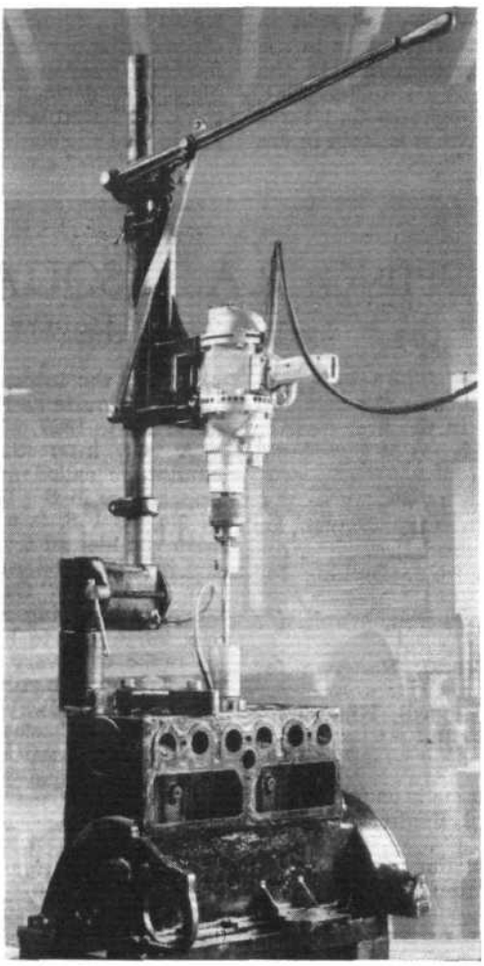
Present at the demonstration last Friday was Mr. H. Kerr Thomas, M.I.Mech.E., M.I.A.E., M.A.S.M.E., who acted as impartial adjudicator. For the subject of the demonstration had been chosen a car engine with badly worn cylinder bores, and the particular bore chosen by Mr. Kerr Thomas had a bad ridge about 1·5 in. from the bottom, while the top of the bore was oval to the extent of 7·5 thousands, and had a mean taper from bottom to top of 13·7 thousands. At the end of the demonstration Mr. Kerr Thomas measured the bore with a three-point dial indicator, and his results were: Bore in direction of crankshaft, top 3·172 in., bottom 3·1715 in. In the direction at right angles to the crankshaft the bores were: top 3·172 in., bottom 3·1715 in. Thus the bore was finished accurate to within one-half thousandth inch. The ground surface was found to be very good, and at least equal to work produced by ordinary shop methods. The time occupied was 21·5 minutes, not counting herein a short stop for changing the grinding blocks from a coarse to a fine grade.

As we have said, the particular model demonstrated was a small one, in which the grinding blocks were rotated by an electric drill, the stroke being provided by a "pump handle," as shown in our photograph. Several other models are, however, available, and in the United States we understand that hundreds are in use, in which all-electric drive is used, and four or six cylinders are ground simultaneously. These larger machines are, of course, used during engine manufacture, and not as repair outfits.

Bores from the smallest to the largest can be ground by this method, among the larger work undertaken being locomotive cylinders and even large gun barrels!

The application to aero engine work is that which interests us most, and we are informed that the Bristol Aeroplane Company has used the "Hutto" grinders successfully for some considerable time, while Armstrong-Siddeley Motors have recently installed an outfit.

Fundamentally the "Hutto" cylinder grinder consists of a set (6, 9 or more) of stones of a carborundum-like substance partly imbedded in a white metal in a sheet steel trough. The stones, of course, vary in size according to the bore which they are intended to grind, and various grades of coarseness are available, the work being begun with a coarse grade of stones and finished with a finer, or even with cast iron "stones" where a polished finish is desired.

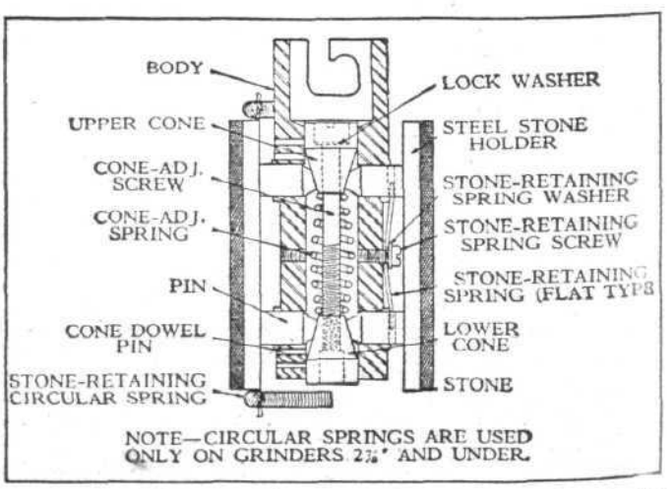


A "Hutto" Cylinder Grinder (small type) demonstrated at the works of Harvey Frost and Co., Ltd. In this type the stroke is obtained by means of a "pump handle." (FLIGHT *Photo.*)

The ingenious feature of the "Hutto" grinder is the manner in which the stones are expanded radially from the centre of the spindle. The sectional view will help to make the arrangement clear. Near each end the central spindle carries a cone. One end of the spindle is threaded, and when rotated by means of the adjusting sleeve the two cones are brought together against the pressure of the spring placed between them. Surrounding the spindle is the body of the grinder, and in the sides of this are holes for the pins of the stones. The ends of these pins are bevelled to the same angle as the cones, and when, therefore, the cones are brought closer together, the stones move outwards while remaining perfectly parallel. The stones are retained in contact with the cones by means of two circular springs, one at each end of the stones. After sliding the grinder into the cylinder bore, the stones are expanded by means of the adjusting sleeve at the top, and after a short run the grinder is stopped, the stones expanded a known amount, and the grinder started again, and so on until the job is finished.

A bayonet joint is provided at the top for the drive, and a universal joint is provided so that if the driving shaft is slightly out of alignment with the grinder the accuracy of the work is not affected.

The demonstration indicated the good results that may be obtained, but in aero engine work we have very few thousands to play with, and even greater accuracy, and better finish, are demanded. We are informed, however, that these can be provided, and in that case the "Hutto" grinder should find its uses in all aero engine works. Those desiring further particulars are asked to communicate direct with Harvey Frost and Co., Ltd., at 148-150, Great Portland Street, London, W.1.



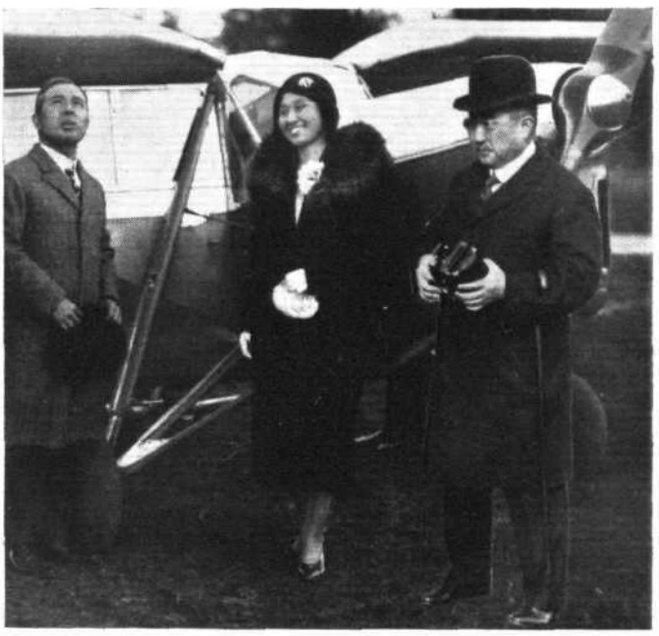
The "Hutto" Cylinder Grinder. This sectional view shows all the important details.

PRIVATE FLYING AND CLUB NEWS

JAPANESE ROYALTY AT HANWORTH.—Last Sunday, March 22, their Imperial Highnesses the Prince and Princess Takamatsu visited Hanworth club. Prince Takamatsu is younger brother of the Emperor of Japan and is on a very short visit to this country, so short that he will only be here four days, but despite that fact he showed his interest in aviation by spending a very large portion of Sunday at Hanworth. The party, which was greeted by Col. The Master of Sempill on their arrival to luncheon, also included His Excellency the Japanese Ambassador and Madam Matsudaira, Commdr. Yamagata, Mr. Ishikawa, Lt.-Comdr. Mizuno, Mr. Renjo Sawada (First Secretary to the Emperor), The Director of Civil Aviation and Mrs. Shelmerdine, Admiral Sir Cyril Fuller (Second Sea Lord) and Lady Fuller, Commodore Snagge, Air Vice-Marshal Lambe, Air Commodore and Mrs. Weir, Mr. and Mrs. Nigel Norman, Lord and Lady Swaythling, Capt. and the Hon. Mrs. Victor Bruce. After lunch, the royal party were shown over the club and the aerodrome, and subsequently given a flying display. Flt-Lt. H. M. Schofield put up a very fine show of aerobatics on a Moth. Mr. Brie displayed the unique flying qualities of the Autogiro, and Mr. Staniland gave the onlookers some idea as to why the Belgian Air Force chose the Fairey Firefly II in the face of many competitors. Later in the afternoon, Princess Takamatsu made her first flight in a Puss Moth, piloted by Col. Sempill.

AT BROOKLANDS.—The new quarters of Brooklands Aviation, Ltd., which, it is hoped, are to be the nucleus of the first University of the Air, are now in the hands of the decorators, but will be ready shortly. Two matters of interest during the last week were the arrival of Lieut.-Comm. Glen Kidston's Lockheed "Vega," and the test flights of the Vickers-Napier, which Messrs. Stack and Chaplin are shortly flying to Australia on a kind of demonstration mail trip. The school itself is busy with several members under instruction, and Mr. S. Jackson successfully completed his tests for his "B" licence.

SURREY FLYING SERVICES have recently put through a very versatile pupil for his "A" licence, in Mr. L. G. Wise. Mr. Wise is a saxophonist at the Piccadilly Hotel, and after he had taken his ticket, he decided that even flying did not give him sufficient thrills, so he proceeded to Heston, where he demonstrated the efficiency of a Russell Lobe parachute in inexperienced hands, by making a jump from 1,000 ft. He landed perfectly successfully, just clear of the aerodrome, and now we understand is so enamoured with the experience, that he is proposing to repeat it shortly, and at the same time play his saxophone during the descent. Is it possible that such circus turns as this will be a regular feature of our flying meetings during the forthcoming season?



JAPANESE INTEREST IN AVIATION: (From right to left), Prince Takamatsu, Princess Takamatsu and Lt.-Comm. Mizuno just after examining a Puss Moth. (FLIGHT *Photo.*)

THE AUTOGIRO AT HANWORTH: Col. Sempill explains the "old Dutch scenery" to Princess Takamatsu. (FLIGHT *Photo.*)

BALDONNEL TO HESTON.—Mr. Andy Woods, a young member of the Irish Aero Club, recently flew from Baldonnel to Heston in a D.H. Moth. Apparently since his machine was an Irish one, he had to fill his luggage locker nearly full with forms of various kinds, but in spite of the time taken to get these signed by the officials, the journey only took him 3½ hr. Those contemplating a similar journey should remember that there is a reporting service in operation between Holyhead and Baldonnel and pilots flying across should circle the meteorological station at Holyhead until receiving an O.K. signal in the form of a white flashing light, so that their safe arrival on this side may be telephoned back to Baldonnel.

BRITISH FLYING CLUBS

Aberdeen Aero Club.—Sec., 123½, Union Street, Aberdeen.
A.O.C. Flying Club.—Sec., 8, New Street, Lincoln's Inn, W.C.2.
Bedford Flying Club.—Sec., 5, Beresford Road, Bedford.
Bedfordshire Aero Club.—Sec., "Winsthorpe," The Embankment, Bedford.
Belfast Aviation Club.—Sec., "Inglenook," 376, Upper Beersbridge Road, Belfast.
Berks, Bucks and Oxon Aeroplane Club.—Sec., 112, Highmoor Road, Caversham, Reading.
Blackpool and Fylde Aero Club.—Sec., Stanley Park, Blackpool.
Bolton Light Aeroplane Club.—Sec., 7, Bute Street, Bolton.
Bournemouth Aero Club.—Sec., 16, Howard Road, Bournemouth.
Bristol and Wessex Aeroplane Club, Ltd.—Sec., Bristol Air Port, Whitchurch, near Bristol.
Britannia Aeroplane Club.—Sec., Royal Naval College, Dartmouth.
Brooklands Aero Club.—Sec., Brooklands Aerodrome, Weybridge, Surrey.
Cinque Ports Flying Club.—Sec., 114, High Street, Hythe, Kent.
Cranwell Flying Club.—Sec., Cranwell Cadet College, Lincs.
Derby and District Aero Club.—Sec., "Beechwood," Snelstone, near Cubley, Derbyshire.
Dunlop Aero Club.—Sec., Fort Dunlop, Erdington, Birmingham.
Essex Flying Club.—Sec., 30, Hamilton Avenue, Ilford.
Experimental Light 'Plane Club.—Sec., Lenten Fields, Nottingham.
Felixstowe Light Aeroplane Club.—Sec., Marine and Experimental Establishment, R.A.F., Felixstowe.
Grimsby Light Aeroplane Club.—Sec., 46, Bradford Avenue, Cleethorpes.
Halton Aero Club.—Sec., No. 1 School of Technical Training, R.A.F., Halton Camp, Bucks.
Hampshire Aeroplane Club.—Sec., Hamble Aerodrome, Southampton.

Hanworth Flying Club.—Sec., London Air Park, Feltham, Middlesex.
Hastings Aero Club.—Sec., 46, Havelock Road, Hastings.
Household Brigade Flying Club.—Sec., The Guards Club, London, W.1.
Hull Aeroplane Club.—Sec., Hull Municipal Aerodrome, Hedon, Yorkshire.
Isle of Purbeck Light Aero Club.—Sec., Swanage Aerodrome, Worth Matravers, Dorset.
Isle of Wight Flying Club.—Sec., The Aerodrome, Shanklin.
Kent Flying Club.—Sec., Bekesbourne, near Canterbury.
Lancashire Aero Club.—Sec., Avro Aerodrome, Woodford, Cheshire.
Leicestershire Aero Club.—Sec., Desford, Leicester.
Liverpool & District Aero Club.—Sec., Hooton Park, Hooton, Cheshire.
London Aeroplane Club.—Sec., 3, Clifford Street, London, W.1.
Midland Aero Club.—Sec., 22, Villa Road, Handsworth.
Newcastle-on-Tyne Aero Club.—Sec., Cramlington Aerodrome, Northumberland.
Norfolk and Norwich Aero Club.—Sec., Mousehold Aerodrome, Norwich.
Northamptonshire Aero Club.—Sec., 20, Market Square, Northampton.
Nottingham Flying Club.—Sec., Nottingham Municipal Aerodrome, Tollerton, Notts.
Plymouth Aero Club.—Sec., 35, Connaught Avenue, Plymouth.
Preston and District Aero Club.—Sec., Clifton Chambers, 20, Fishergate Hill, Preston.
Reading Aero Club.—Sec., Reading Aerodrome, Woodley, Berks.
Royal Aircraft Establishment Aero Club.—Sec., Meadowcroft, Yateley, Hants.
Scottish Flying Club.—Sec., 101, St. Vincent Street, Glasgow.
Sheffield Flying Club.—Sec., Coal Aston Aerodrome, Sheffield.
South Staffordhire Aero Club.—Sec., Stoke-on-Trent, Municipal Aerodrome, Weir, Staffs.
Southern Aero Club.—Secretary, Shoreham Aerodrome, Sussex.
Southport Aero Club.—Sec., Southport.
Suffolk and Eastern Counties Aeroplane Club.—Sec., The Aerodrome, Ipswich, Suffolk.
Surrey Aero Club.—Sec., Gatwick Aerodrome, Lowfield Heath, near Crawley, Sussex.
West Kent Aero Club.—Sec., Kinghill Aerodrome, Maidstone, Kent.
Windsor Aero Club.—Sec., Bishop's Farm, Oakley Green, Windsor.
Yorkshire Aeroplane Club.—Sec., The Aerodrome, Sherburn-in-Elmet, Yorks.

CANADIAN PUSS-MOTHS : Above are some of the first Puss Moths (Gipsy III) out of a large number to be delivered to the Canadian Government. The three different landing gears, comprising large air wheels, standard wheels and skis should be noted.

GLIDING

THE BRITISH GLIDING ASSOCIATION are to be congratulated on the fact that Lt.-Col. F. C. Shelmerdine, the Director of Civil Aviation, has accepted the presidency, which was held by the late Sir Sefton Brancker until his death. A further announcement of interest is the fact that they have received a substantial cheque towards their funds from the De Havilland Aircraft Company. On March 17, Capt. H. H. Balfour, speaking in the House on the air estimates did his best to stir up some enthusiasm with regard to gliding, by saying . . . "I repeat as regards civil aviation, we are starting at the wrong end in carrying passengers instead of freight. Light aeroplane clubs are excellent, but we ought to go beyond light aeroplane clubs—we ought to start with gliding. If we could, in this country, increase the democratic interest of the mass of the people in flying—and, after all, we cannot impose a new industry or a new art on people unless they are receptive, and wish to receive that new art or new industry—if we can get them interested, then the thing will go ahead with the national good will behind it. A light aeroplane is very much out of the reach of most average citizens of this country, and even joining a light aeroplane club is somewhat out of their reach, but modern motorless flying is not out of their reach. Germany, I think, gave last year a subsidy of £16,000 for motorless flying; France has given £6,000 for motorless flying; and if we could spare a small contribution of money for this system of motorless flying, I believe we should lay the foundations on the widest possible basis, for building up a national interest and pride in aviation. In every new age there is one new development. We had the iron ship, we had the steam engine, and we had the internal-combustion automobile engine, though we gave that away to America. We are the leading shipbuilders of the world; we are the leading steam engine builders of the world. There is just one new chance in every age and generation, and our chance in this generation is to be the leading country in air matters. This is a matter which is so vital that I trust it will never become a matter of party politics. It is a matter for which any Government of any party is vitally responsible, because the Government have in their power the furthering of the greatest gift which this House can give, and that is the gift of development and progress to future generations."

THE LONDON GLIDING CLUB.—In spite of low winds, some excellent flights were made on the club's Prüfling, on Saturday, March 14, and one member qualified for his "B" licence. Wind conditions remained unsuitable on Sunday, March 15, and the members devoted their time to instructional flights. Owing to the success which attended the gliding camp last summer, the experiment is being repeated during Easter, from April 2 to 6, inclusive. The charge for the whole period is £2 3*s.* 6*d.*, and includes accommodation, flying, instruction and meals, without meals, £1 1*s.* Five machines will be in use. The club is also organising a trip to the Wassekuppe for the Rhön competitions from July 25 to August 9. The inclusive charge is £15 4*s.* 3rd class, and £17 2*s.* 2nd class, and is open to non-members. Those who are interested in this event should communicate with Thomas Cook & Son, Ltd., Berkeley

Street, W.1, and quote reference B.H. 68/51435, when full particulars will be sent. The clubs' two-seater "Popenhagen," which has been stored for some time, will be in regular use, as sufficient hangar accommodation will soon be available. There are still vacancies for new members, and these should communicate with the Secretary, Empire House, St. Martins-le-Grand, E.C.1.

THE SAILPLANE CLUB started flying again last Sunday, March 22, at Smalldole, and quite a large number of members were present. Many short flights were made from comparatively level ground, and all members were able to get in three flights each during the afternoon. Miss Mary Knightly, the club's first lady pilot, reached a height of some 20 ft., and made a successful landing, although at one time it looked as if she might do so somewhat heavily. In view of the exceptional success of the last dance another one is being held at the Suffolk Galleries on Saturday, April 25, and tickets can be booked from the hon. Secretary, E. G. Smettem, 2, Wine Office Court, Fleet Street, E.C.2.

ULSTER GLIDING.—The Ulster Gliding and Aviation Club held their inaugural meeting on March 14. A large number of members made their first flights, and enthusiasm in the district is very strong.

GLIDING IN GERMANY.—Herr Starck has recently been investigating a method of gaining height by being towed in a glider behind a motor driven aircraft, and he was towed up to between 7,000 and 9,000 ft. above Darmstadt Aerodrome, from whence he flew to Frankfurt Aerodrome in about 2 hr., and subsequently made a return journey in the same manner after regaining his height by means of the "tow." The gliding school at Rositten is using slow motion films of a falcon in flight to instruct their students in the elements of flying. Films are also to be taken of eagles in flight and used for the same purpose.

GLIDING IN AUSTRALIA.—The Larkin Co. have established a soaring club and use a Larkin "Lark," which has been designed and built at Melbourne. The main details are :—wing span, 38 ft. ; aspect ratio, 8 ft. ; length overall, 18 ft. 6 in. ; wing chord, 4 ft. 9 in. ; wing area, 180 sq. ft. ; height overall, 4 ft. 7 in. ; loaded weight, 380-400 lb. ; landing speed, 22 m.p.h. ; optimum gliding angle, 1 in 17 ; gliding speed, 34 m.p.h. ; sinking speed, 2·7 ft. per sec.

THE AIRCRAFT CLUB, Harrogate.—The Aircraft Club again visited the Nidd Valley on Sunday, March 22, and a soaring flight of 2½ min. was found to be possible. In view of the small size of the fields, and the fact that many landings have to be made later over stone walls, this particular form of landing was the subject of special practice, and many flights were made with this in view.

THE EDINBURGH GLIDING CLUB is progressing very satisfactorily despite the fact that it was founded rather late in the past season.

The club at present possesses two primary gliders—a B.A.C. II and a German model—and intend to construct, at an early date, a soaring and sailplaning machine. The club has had to rely on the generous assistance of Mr. Young, of Meadowfield Farm, and Mr. Bryce, of West Craigs Farm, with regard to ground, and its members wish to express their gratitude to these gentlemen for their invaluable support.

BRITISH GLIDING CLUBS

Abergavenny and District Gliding Club.—Sec., "Trossachs," Park Crescent, Abergavenny.
Accrington Gliding Club.—Sec., 67, Eagle Street, Accrington.
Aircraft Club Harrogate.—Sec., The White House, Starbeck, Harrogate.
Banbury Gliding Club.—Sec., Tadmarton Lodge, Banbury.
Barnoldswick Gliding Club.—Sec., 49, Church Street, Barnoldswick.
Barnsley Gliding Club.—Sec., 20, Rowland Road, Barnsley.
Barrow-in-Furness Gliding Club.—Sec., 31, Church Street, Barrow-in-Furness.
Bedford Gliding Club.—Sec., 5, Beresford Road, Bedford.
Belfast Gliding Club.—Sec., 21, Deerpark Drive, Belfast.
Birmingham Gliding Club.—Sec., 105, Hunters Road, Handsworth, Birmingham.
Bolton Gliding Club.—Sec., 7, Bute Street, Bolton.
Bradford Gliding Club.—Sec., 17, Roslyn Place, Bradford.
Bridlington Gliding Club.—Sec., Crescent Court Esplanade, Bridlington.
Brighton Gliding Club.—Sec., Hanover Crescent, Brighton.
Bristol Gliding Club.—Sec., 14, Woodstock Road, Redland Green, Bristol.
Cardiff Gliding Club.—Sec., 59, Queen Street, Cardiff.
Channel Gliding Club.—Sec., 42, Rendezvous Street, Folkestone.
Comrie Gliding Club.—Sec., Lawers Comrie, Perthshire.
Cononley & District Gliding Club.—Sec., 178, Skipton Road, Keighley.
Coventry Gliding Club.—Sec., Llangstone, Job's Lane, Coventry.
Dalkeith Gliding Club.—Sec., Elmfield Works, Dalkeith.
Derby and District Gliding Club.—Sec., "Beachwood," Snelstone, near Cubley, Derbyshire.
Doncaster Gliding Club.—Sec., 88, Alfred Road, Askern, near Doncaster.
Dorset Gliding Club.—Sec., 4, Derby Street, Weymouth. Central Information Office, 5, Royal Arcade, Weymouth.
Dover Gliding Club.—Sec., 106, High Street, Dover.
Dover Sailplane Club.—Sec., 24, East Cliff, Dover.
Driffield and District Gliding Club.—Sec., The School House, Gembling, Driffield, Yorks.
Dumfries and District Gliding Club.—Sec., Thornlea, Totchell Park, Dumfries.
Dunlop Aero Section.—Manufacturers' Section, The Dunlop Rubber Co., Fort Dunlop, Birmingham.
East Grinstead Gliding Club.—Sec., Oakdene, Sackville Lane, East Grinstead.
Eastbourne Gliding Club.—Sec., 81, South Street, Eastbourne.
Edinburgh Gliding Club.—Sec., 16, Bernard Street, Leith.
Egham Gliding Club.—Sec., 46, Wendover Road, Egham.
Elgin Gliding Club.—Sec., 71, Smith Street, Elgin.
Essex Gliding Club.—Sec., 17, Randolph Road, Walthamstow.
Everley Gliding Club.—Sec., Crown Hotel, Everley, near Todworth, Wilts.
Exeter Gliding Club.—Sec., 5, Bank Street, Newton Abbot.
Falkirk and District Gliding Club.—Sec., 122, High Street, Falkirk.
Furness Gliding Club.—Sec., 31, Church Street, Barrow-in-Furness.
Glasgow Gliding Club.—Sec., 70, Exeter Drive, Glasgow, W.1.
Grosvenor Gliding Club.—Sec., Horsely House, Commercial Street, Consett, Co. Durham.
Halifax Gliding Club.—Sec., 94, Lister Lane, Halifax.
Halton Gliding Club.—Sec., Halton Camp, Bucks.
Harrogate Gliding Club.—Sec., The White House, Starbeck, Harrogate, Yorks.
Herts and Essex Gliding Club.—Sec., 110, Dunmow Road, Bishop's Stortford.
Huddersfield Gliding Club.—Sec., The Cottage, Woodside, Fartown, Huddersfield, Yorks.
Hungerford Gliding Club.—Sec., Hidden Cottage, Hungerford, Berks
Ilkley and District Gliding Club.—Sec., Red Lion Hotel, South Stanley, near Harrogate.
Imperial College of Science Gliding Club.—Sec., Imperial College of Science and Technology, South Kensington, S.W.7.
Isle Thanet Gliding Club.—Sec., 17, Chapel Place, Ramsgate.
Isle Wight Gliding Club.—Sec., 61, Swansmore Road, Ryde.
Jersey Gliding Club.—Sec., Meadow Bank, St. Lawrence, Jersey, C.I.
Kendal Gliding Club.—Sec., Atkinson & Pollitt, Kendal.
Kent Gliding Club.—Sec., 14, King Street, Maidstone.
Kilmarnock Gliding Club.—Sec., 7, Low Glencairn Street, Kilmarnock.
Ladybank Gliding Club.—Sec., Woodside, Ladybank, Fife.
Lancashire Gliding Club.—Sec., Alderley Edge, Cheshire.
Leeds Gliding Club.—Sec., 32, Fearnville Grove, Roundhay, Leeds.
Leicestershire Gliding Club.—Sec., 12, Tichbourne Street, Leicester.
Lincoln Gliding Club.—Sec., The Manor House, Cherry Willingham, Lincoln.
Littleborough Gliding Club.—Sec., Oakdale, Deainley Littleborough, near Manchester.
Littlehampton Gliding Club.—Sec., 17, New Road, Littlehampton.
Llandudno Gliding Club.—Sec., Craigydon, Llandudno.
London Gliding Club.—Sec., Empire House, St. Martin's-le-Grand, E.C.1.
Loughborough Gliding Club.—Sec., Hoton, near Loughborough.
Malton Gliding Club.—Sec., Welburn, York.
Manchester Gliding Club.—Sec., "Cyntra," Poplar Road, Didsbury, Manchester.
Matlock Gliding Club.—Sec., Dean Hill Villas, Matlock.
Merthyr and District Gliding Club.—Sec., "Ingleside," The Walk, Merthyr Tydfil, Glamorganshire.
Midland Gliding Club.—Sec., Central Arcade, Wolverhampton.
Newcastle Mechanical Club Gliding Section.—Sec., 27, Philliphaugh, Wallsend-on-Tyne.
Norfolk and Norwich Gliding Club.—Sec., Norwich.
North Cotswold Gliding Club.—Sec., Evesham, Glos.
North Kent Gliding Club.—Sec., 71, York Street, Basford, Stoke-on-Trent.
North Lindsay Gliding Club.—Sec., 3, Wells Street, Scunthorpe.
North Staffordshire Gliding Club.—Sec., 3, Havelock Place, Shelton Stoke-on-Trent.
Nottingham Gliding Club.—Sec., 117, Hilton Road, Mapperley, Notts.
Oxford County Gliding Club.—Sec., 11, Frenchay Road, Oxford.
Pilning Gliding Club.—Sec., New Passage Hotel, Pilning, Gloucester.
Portsmouth and Southsea Gliding Club.—Sec., 9, King's Terrace, Southsea.
Preston and District Gliding Club.—Sec., "Lendor," Lawrence Road, Penwortham Hill, Preston.
Rainford Gliding Club.—Sec., "Calderbrook," Rainford, Lancs.
Richmond (Yorks) Gliding Club.—Sec., West End Garage, Richmond (Yorks).
Rugby Gliding Club.—Sec., Birdingham, near Rugby.
Sailplane Club of T.M.A.C.—Sec., 2, Wine Office Court, Fleet Street, E.C.4.
Scarborough Gliding Club.—Sec., Royal Hotel, Scarborough.
Sheffield Gliding Club.—Sec., 14, Perigree Road, Woodseats, Sheffield.
Southampton Gliding Club.—Sec., 14, Cumberland Place, Southampton.
Southdown Skysailing Club.—Sec., New Yorke Hotel, Bedford Square, Brighton.
Southend-on-Sea Gliding Club.—Sec., 43, Northview Drive, Westcliff-on-Sea.
South Essex Gliding Club.—Sec., 41, Hall Road, Chadwell Heath.
South Shropshire and North Herefordshire Gliding Club.—Sec., Bull Ring, Ludlow, Shropshire.
St. Helens Gliding Club.—Sec., Carn Brae, Moss Bank, St. Helens, Lancs.
Stirling and District Gliding Club.—Sec., Blairlogie Park, Blairlogie, Stirling.
Stockport Gliding Club.—Sec., Radio House, Sandy Lane, Stockport.
Suffolk and Eastern Counties Gliding Club.—Sec., The Aerodrome, Hadleigh, Suffolk.
Surrey Gliding Club.—Sec., 24, Woodbridge Hill Gardens, Guildford.
Whitehaven Gliding Club.—Sec., "Summerfield," 4, Hensingham Road, Whitehaven.
Wiltshire Gliding Club.—Sec., 8, Savernake Street, Swindon.
Winchester Gliding Club.—Sec., Fordington Road, Winchester.
Wolseley Gliding Club.—Sec., Wolseley Motors, Ltd., Ward End, Birmingham.
Worthing and District Gliding Club.—Sec., 101, Rowlands Road, Worthing.
Wrexham and District Gliding Club.—Sec., Warings Service Garage, Bradley Road, Wrexham.

AIRPORT NEWS

CROYDON NOTES

THE beautiful weather of the past week has kept us busy, and the services have run to schedule. Such weather as this, and our numbers of passengers carried in and out of this airport should rapidly increase.

On Tuesday Mr. A. A. Salem, of Magdalene College, Cambridge, an Egyptian undergraduate, left here for Egypt. He was flying G-EBYP, the Moth on which Capt. W. L. Hope won the King's Cup several years ago. This aircraft has been of great service to Air Taxis, Ltd., on special charter work all over the Continent. Mr. Salem is flying home for his Easter vacation. Highly-placed Egyptian officials gathered to give him a send off, including the Egyptian Minister.

The first inward-bound African Air Mail arrived on Thursday, piloted by Mr. Wheeler. As may be imagined, it was the subject of much photography by the press.

During the same afternoon, a "Berline Spad" arrived from Hanworth on its way to Paris. It is so many years since we saw a Spad, we were quite bewildered. This machine, which belongs to M. Bleriot, was being taken to Paris by M. Darnaud, of the Air Union Co.

Mention of the Air Union Co., a considerable number of their flight engineers have taken their pilot's tickets, and are operating the services. They all appear to be very sound pilots, and there is little doubt that in a very short while they will rank with the leading pilots.

This seems a splendid idea of the French Co., to give their mechanics a chance to advance themselves, and they will undoubtedly be well repaid with the faithful service of these men. Every mechanic must have moments when he visualises himself as a pilot, and this company are giving their more experienced flight engineers a chance to prove their abilities.

When the Belgian Night Air Mail was leaving on Thursday, for Brussels, Mr. Knight, the well-known Customs Officer at Croydon, went out to seal up the doors of the machine. While carrying out this duty, the pilot obliged by opening up his left engine, and in consequence, Mr. Knight had his pince-nez whisked off, and shattered to atoms on the ground. Some pilots are very apt to play this trick—it really isn't fair. Mr. Knight is making a claim for his glasses, and quite rightly. The incident was humorous to those whom it did not concern.

Endeavouring to help pilots still further in bad weather, and particularly in fog, a wide chalk line, 600 yards long, is in course of construction on the aerodrome at the south end. The line runs approximately from east-south-east to west-north-west.

Croydon was concerned on Saturday with supplying machines for the boat race. Every available machine was booked. Twenty-four aircraft left here, and had there been another twenty-four, they could have been filled. Imperial Airways had five full loads, comprising two Argosies, two Handley Page W.10s, and a De Havilland 50.

Surrey Flying Services, Rollason Aviation Co., Henderson Aviation Bureau, and Personal Flying Services all had their share of passengers. After the race Imperial Airways had another two large parties awaiting flights.

The smaller companies were busy throughout the week-end, and business was exceptionally good. If the season carries on like this, everyone in the business of joyriding should prosper.

The National Aircraft Factory failed to fall under the hammer on March 10, and is now up for sale by private treaty. It is appalling to see such an enormous place going into decay for want of attention. Walking around there recently, one was dismayed to see the utter desolation everywhere, junk, rank weeds, windows broken, and yet it could be made into a veritable hive of industry by some enterprising concern.

Lt.-Cmdr. Glen Kidston, R.N., is now ready for his flight to the Cape. He will be accompanied by Mr. Cathcart-Jones as assistant pilot, and Mr. Tom Villette, of the Marconi Company, as wireless operator. We wish them all good luck and hope to see the Lockheed Vega back here soon.

A rather amusing incident occurred on Sunday morning. Mr. Caspareuthus, well-known for his Cape flight, was due to proceed to Paris as second pilot on the outward-bound morning service. Being rather fond of taking his meals in the air, he ordered his eggs, bacon and coffee to be put aboard the machine. Unfortunately for our hero, his flying kit required quite a lot of adjustment, and he then discovered that someone had "borrowed" his wireless gear. Meanwhile the giant air liner had proceeded to taxi towards its taking-off position, and finally when she took the air poor old Caspareuthus was heard to exclaim "There goes my —— breakfast!"

The traffic figures for the week are: Passengers, 525; freight, 38 tons.

P. B.

HESTON NOTES

HESTON has had a particularly encouraging week-end. Throughout Saturday and Sunday there were between 20 and 30 private machines on and round the aerodrome, and the club house was thronged with members and visitors.

There were many interesting arrivals and departures. On Friday, Mr. Sanaika, after only 30 hours' flying experience, left with a friend in a Moth for Egypt, after saying goodbye to the Egyptian Minister, who came to see him off. He is the third Egyptian to return homeward by air.

On Saturday morning, Capt. Dan Cameron left early for Nairobi in the Avro V, which has just been overhauled for service in East Africa with Wilson Air Lines.

Lieut.-Comm. Glen Kidston, R.N., paid two visits with the Lockheed-Vega, which was immediately beseiged by interested visitors. As is well known, he leaves shortly to attempt a record flight to the Cape and back.

On Sunday, towards evening, a sudden roar announced the arrival of Flt.-Lieut. Staniland, who put up a superb performance on the Fairey "Firefly," and disappeared as quickly as he could without landing for applause.

The new "Meteor II" arrived from Brough shortly afterwards, and on being opened was found to contain Mr. Gordon Selfridge, Junr., who intends to take it to Seville next week. It differs from the "Meteor I" in having a metal fuselage and the construction has been modified so as to place the centre of gravity further forward. It has a pay load of 350 lb. more than the "Meteor I."

DEVELOPMENTS AT HULL

MUNICIPAL Airports in Great Britain are not growing in number at a very great rate—so far, only eight "official" Municipal airports have been established—but some of those that *have* got going are showing a keen enthusiasm in the development of their airport. For example, the Hull Municipality, for some time past, have been making every effort to develop and improve their airport at Hedon, with a view to making it one of the premier airports in Great Britain.

At present, activity at the airport is mainly confined to club work and joy-riding by National Flying Services (N.F.S., it will be remembered, have a club house at Hedon), occasional taxi services, etc., but it is Hull's ambition that the airport should be the centre of internal and international air services.

In fact, just recently, the question of a mail and passenger air service to Denmark and Norway has been given serious consideration. Hull, it has been pointed out, is very favourably situated for such a service, especially with a seaplane base located on the Humber at Paull, and Hedon was developed as an airport with this end in view. The financial aspect of such a scheme has, however, prevented it from being proceeded with in any practical form, but the announcement made recently that a rival scheme was put forward at Newcastle has stirred Hull into activity.

A few weeks ago, Alderman B. Pearlman, chairman of the Corporation Aerodrome Committee, Sir Arthur Atkinson, chairman of the Hull Aero Club, Councillor F. Till, chairman of the Development Committee, and others, met the Lord Mayor at the Guildhall to discuss the state of affairs. Apparently, it is now only a matter of finance—Councillor Till stated that if about £50,000 could be raised there would be little difficulty in establishing an air line to north Europe, with probable help from the Air Ministry.

Meanwhile, Hedon is being developed in other respects, for the aerodrome and its vicinity is being offered as a suitable locality for aircraft works, and in this respect, claims many advantages. One firm, in fact, is already established there—*i.e.*, the Civilian Aircraft Co.

The AIRCRAFT ENGINEER

FLIGHT ENGINEERING SECTION

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CONTENTS

A GRAPHICAL METHOD OF STRESSING AEROPLANE SPARS.

By D. Williams, B.Sc., A.M.I.Mech.E.

[*Some time ago Mr. H. B. Howard of the Air Ministry developed a graphical method of stressing aeroplane spars, the theory of the method being described in R. & M. No.* 1233. *As there presented, the method was hardly suitable for use in the design office, and Mr. Williams, who is one of the Technical Officers at the Royal Aircraft Establishment at Farnborough, has now given a new presentation of Mr. Howard's method, intended particularly to be readily applied in the design office. The first instalment of Mr. Williams' article appears below.*—Ed.]

A very useful method of stressing aeroplane spars was recently developed by Mr. H. B. Howard, B.A., B.Sc. The theory of the method and examples of its use have been given by Mr. Howard in R. & M. No. 1233. The purpose of the following description is to enable anyone in the design office to apply the method without necessarily mastering the theory.

The method makes it possible to deal expeditiously with end loaded spars in which any number of discontinuities, either of loading or moments of inertia of spar section, occur. In such cases it is much superior to any analytical method, as it entirely does away with the necessity for solving a large number of simultaneous equations.

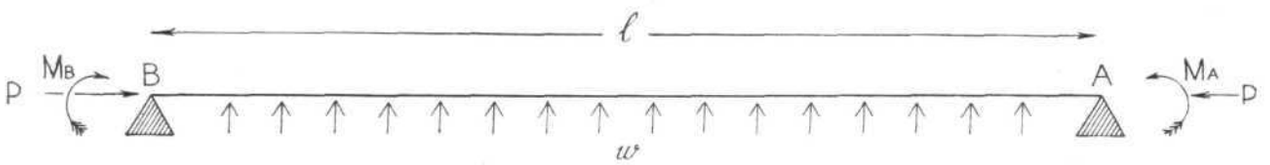
The following nomenclature will be used:—

Main bay of spar = length of spar between two consecutive points of support.

Sub-bay of spar = length of spar between two discontinuities in the same main bay.

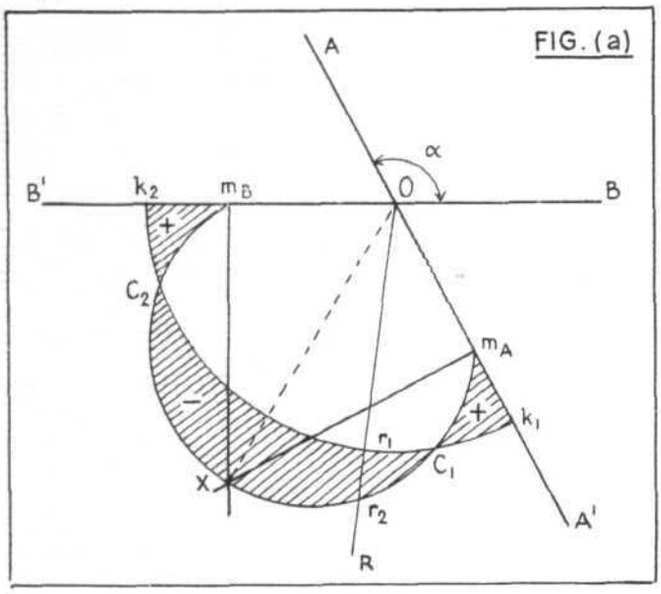
P = end load in main bay.
E = Young's modulus for the material of the spar.
I = moment of inertia of the spar section.
μ^2 = P/EI
w = spar loading in lb. per inch run (+*ve* when in upward direction).
S = true shear.
i = slope of spar (i_B = slope at B).
a = length of a sub-bay.
l_{AB} = length of main bay AB.
α = μa radians = $57 \cdot 3\ \mu a$ degrees.
β = defined below.
θ = „ „
M = true bending moment (+ *ve* when concave side of beam faces upward).
m = $(M - w/\mu^2)$ and is merely a convenient quantity for diagram construction.

Before considering the case of the continuous beam in which, of course, the bending moments at the supports are unknown, the application of the graphical method to the simple case of a single beam supported at its ends and subjected to known end bending moments and a uniformly distributed load will be explained.



Suppose that for a beam AB pin-jointed at A and B, the values of P, I, l, M_A, M_B and w are given. (Note that when M_A, M_B and w are in the directions shown, they are + *ve*). First evaluate μ, w/μ^2, and α ($= 57 \cdot 3 \mu l^\circ$) and proceed with the following construction (see Fig. (a) on next page):—

Draw a horizontal line OB and make the angle $AOB = \alpha$. Produce AO to A^1 and BO to B^1. The space included within the $\angle$ AOB, *i.e.*, the sector AOB, is termed the + *ve* sector, while A^1OB^1 is the — *ve* sector. The circular arcs used in the construction are confined within the limits of these two sectors, those portions of the arcs extending into the regions AOB^1 and BOA^1 not being drawn. With centre O and radius w/μ^2 to a convenient scale draw an arc k_1k_2 in the negative sector A^1OB^1, the rule being that if w is + *ve* (as in the present example) the arc is drawn in the — *ve* sector; if negative, in the positive sector. Measure off $k_2\ m_B$ in the direction B^1B



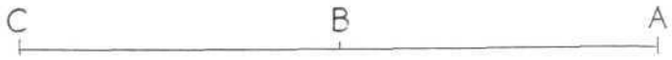
and equal to M_B (if M_B had been negative $k_2 m_B$ would have been in the opposite direction) and similarly $k_1 m_A$ in the direction A^1A and equal to M_A. At m_B and m_A erect perpendiculars to B^1B and A^1A respectively, which cut each other at X. With OX as diameter draw a circular arc $m_B X m_A$. By shading in the space between the two arcs the bending moment diagram is obtained.

Suppose the moment at x ins. from A is required. The linear measurement x is converted into an angular measurement by multiplying by $57 \cdot 3\mu$, giving $57 \cdot 3\ \mu x$.° Draw the vector OR, so that $\angle ROA^1 = 57 \cdot 3\ \mu x$ degrees : the required moment is given by the intercept $r_1 r_2$ between the two arcs. Where the arc $k_1 k_2$ is below the arc $m_A m_B$, the moment is $+ ve$; where the reverse is the case it is $- ve$.

It is seen that the two arcs intersect at two points, C_1 and C_2. Here obviously the bending moment is zero, and, therefore, these points represent points of contraflexure on the beam. The variation of the bending moment as the beam is traversed from A to B is obtained from the diagram by swinging the vector OR from OA^1 to OB^1. At OA^1 (A on the beam) the moment $= k_1 m_A = M_A$ and $+ ve$. It diminishes to zero at c_1, reaches a maximum $-ve$ value at OX, becomes zero again at C_2, and finally reaches a $+ ve$ value equal to $k_2 m_B = M_B$ at OB^1 (B on the beam).

The end load P affects the shear, as well as the bending moment in the beam, and the true value of the shear can also be read off the diagram. For example, the shear at x in. from A, *i.e.*, at OR in the diagram, is obtained by measuring the length of the line joining r_2, the point of intersection of OR and the arc $m_A m_B$, to X, on the bending moment scale, and then multiplying the result by μ.

The case of the single bay with more complicated loading will not be dealt with at this juncture, as the correct procedure is fully covered by the following treatment of the continuous beam. In this treatment it will be found that for any particular bay two diagrams are drawn ; the first enables the bending moments at the supports to be found, and the second is the actual bending moment diagram for the bay based on the end moments and other quantities found by means of the first diagram. When, therefore, it is desired to draw the bending moment diagram for a single bay in which the end moments are known, the procedure is to draw the first diagram as if the bay formed part of a continuous beam, and as if the end moments were unknown ; then to draw the actual bending moment diagram based on the known end moments and the data obtained by means of the first diagram.



Let C, B, A, be three consecutive supports of a continuous beam. As in the ordinary theorem of three moments, the method depends on finding an expression for the slope at B, firstly in terms of the bending moments at A and B and known constants, and, secondly, of those at C and B and known constants for that bay. Equating the two expressions so found gives a relation between M_A, M_B and M_C.

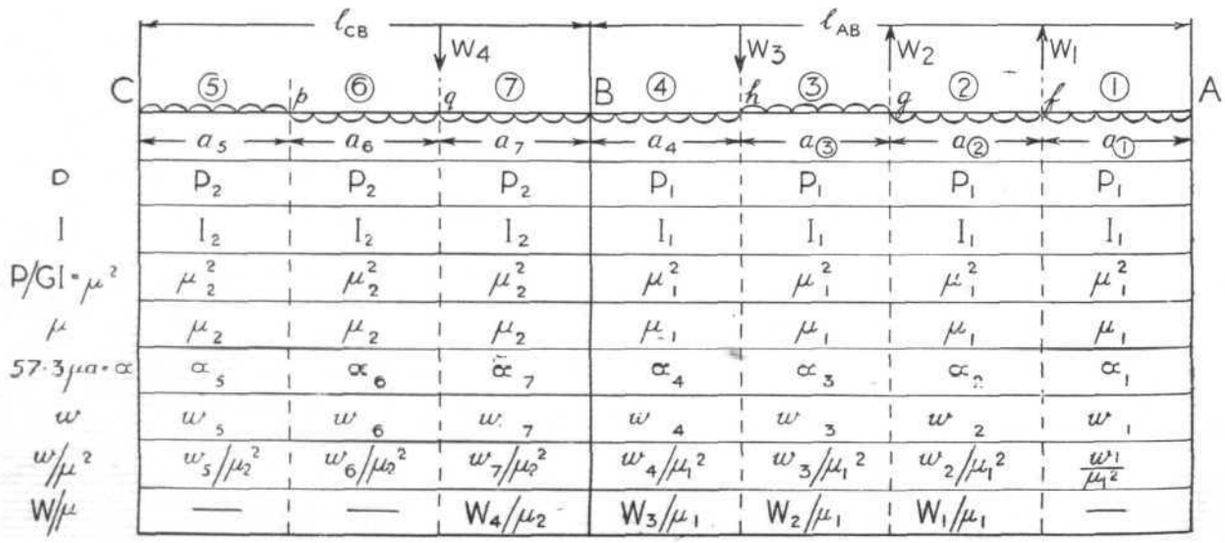
When dealing with bays AB and BC, it is convenient to reckon the directions from A to B and from C to B positive, *i.e.*, directions towards the common point B are $+ ve$. Before equating the two expressions for the slope i_B it will, therefore, be necessary to change the sign of one of them. Once the values of the bending moments at the supports are obtained, the actual drawing of the bending moment diagram is a simple matter, as nothing but straight lines and arcs of circles enter into the construction.

Probably the clearest description of the procedure can be given by dividing it into three parts dealing with

I. Changes of spar loading and concentrated loads.
II. Changes of moments of inertia of spar section.
III. Combination of I and II.

The table of data below is first prepared. Each sub-bay is marked with a number, and the numerical suffixes to the various tabulated quantities denote the values of those quantities for the corresponding bays, *e.g.*, α_3 is the value of α for sub-bay 3. When μ_1 appears under sub-bay 3 it means that the value of μ for sub-bay 3 is the same as that

TABLE I. Changes of Spar Loading and concentrated Loads.



NOTE : P *and* I *are constant over each main bay for this case.*

for sub-bay 1. In the table, a positive or upward concentrated load " W " is marked with an arrow pointing in that direction, while an upward or + *ve* distributed loading " *w* " is denoted by placing a wavy line underneath the horizontal line joining CBA; *e.g.*, W_2 is a + *ve* concentrated load, and w_5 is a downward or negative distributed load. It is assumed that $w_2/\mu_1^2 > w_1/\mu_1^2$, and $w_7/\mu_2^2 > w_6/\mu_2^2$.

In the 5th line of the table the length " *a* " of a sub-bay has been converted into an angular measurement, or sub-sector, by multiplying by a factor $57{\cdot}3\mu$. It is this angular measurement " α " in the polar diagram that corresponds to the linear value " *a* " on the actual spar.

obviously negative: h_1h_2 is therefore directed towards the negative branch of h^1h. At h_2 erect the perpendicular $h_2h_3 = W_3/\mu_1$ to take account of the concentrated load, and as W_3 this time is a downward or negative load, h_2h_3 is drawn to the left of its boundary line h^1h. At h_3 draw the fourth and last locus line ll_4, parallel to ll_3, to cut B^1B in l_4. Measure the angle θ which this last locus line makes with B^1B. (*Note.*—When there is no change of moment of inertia, all the locus lines make the same angle with B^1B, as in this case).

It will have been noticed that at each boundary line a measurement along the line takes account of the change of " *w*," and a measurement perpendicular to the line takes

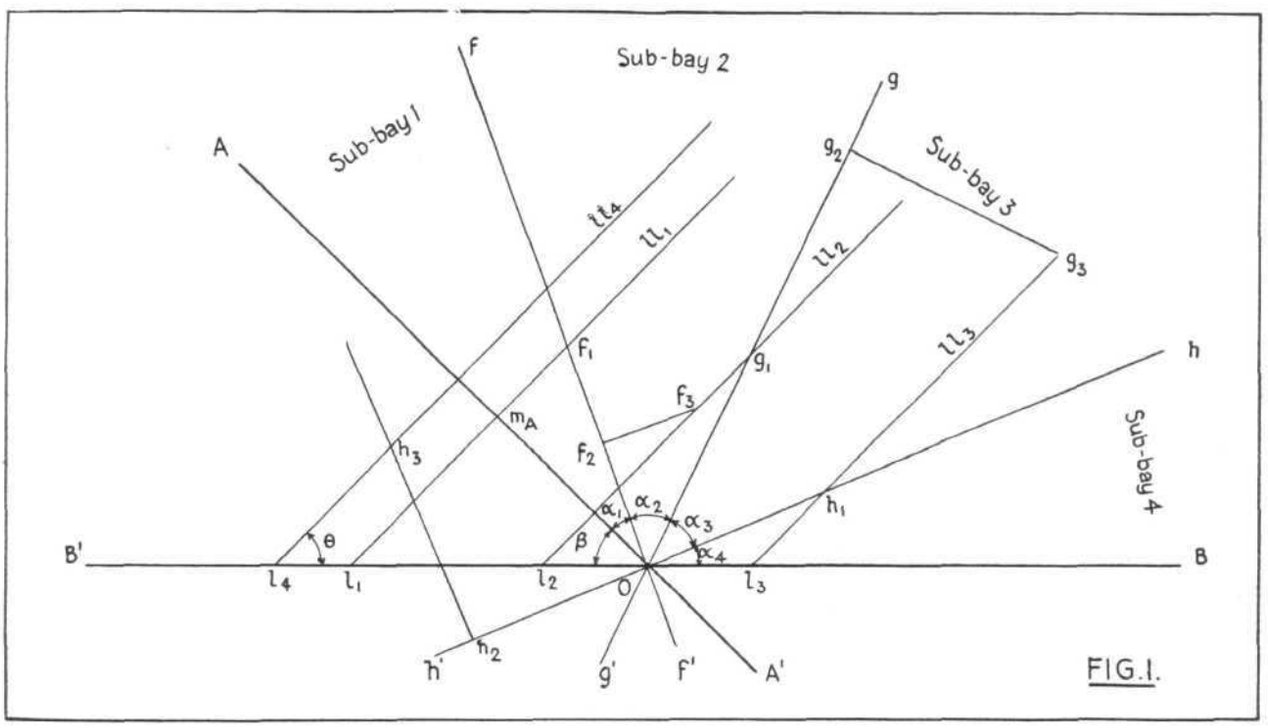


FIG. 1.

Consider the bay AB and refer to Fig. 1. With OB horizontal, draw the angle $AOB = (\alpha_1 + \alpha_2 + \alpha_3 + \alpha_4)$, and then draw the boundary lines O*f*, O*g* and O*h* between these angles. Produce all these lines beyond O to give an equal sector A^1OB.[1] The angle AOB^1 will be called " β." The sector AOB now represents in angular measurement the length of the main bay AB, while the angles AO*f*, *f*O*g*, *g*O*h* and *h*OB represent the sub-bays 1, 2, 3 and 4, respectively, and, for any boundary line, the direction leading from the negative sector to the positive sector is a positive direction, *e.g.*, f^1f is a positive direction, ff^1 a negative one.

Assume that M_A and M_B are both unknown. m_A and m_B being functions of M_A and M_B respectively, will therefore also be unknown. Let the length Om_A represent the value of m_A. At m_A draw a perpendicular to OA cutting the first boundary line f^1f in f_1 and the end boundary line or base line B^1B in l_1. This perpendicular is marked ll_1 and is called the first locus line. Measure off f_1f_2 equal to $(w_1/\mu_1^2 - w_2/\mu_1^2)$ to a convenient scale which will then be used throughout the construction (1 in. = 10,000 lb.-in. is a common one). When this is a negative quantity as it happens to be in this instance, f_1f_2 is measured towards the negative sector along the boundary line f^1f. At f_2 draw a perpendicular f_2f_3 to f^1f and equal to W_1/μ_1. The rule is that if W_1 is positive (as it is here) f_2f_3 is drawn to the right of f^1f looking along the positive direction of that boundary line. Both the discontinuities at this point having now been dealt with, we draw at f_3 a second locus line ll_2 parallel to ll_1 to cut the next boundary line fg in g_1 and the base line B^1B in l_2. Measure g_1g_2 equal to $(w_2/\mu_1^2 - w_3/\mu_1^2)$, and as this quantity is obviously positive (since w_3 is negative), g_1g_2 is measured in the positive direction of the boundary line. At g_2 draw a perpendicular g_2g_3 equal to W_2/μ_1, which, being positive, is drawn to the right as before. At g_3 draw a third locus line ll_3 parallel to ll_2 to cut the next boundary line h^1h in h_1 and B^1B in l_3. Make $h_1h_2 = (w_3/\mu_1^2 - w_4/\mu_1^2)$ which, from Table I, is

account of the concentrated load W. At each boundary line also, the locus line has been shifted parallel to itself by an amount dependent on the length of these measurements. These shifts of the locus line are recorded on the base line B^1B by the points l_1, l_2, l_3 and l_4. Shifts towards B^1 are reckoned positive; towards B, negative. Thus l_1l_2 and l_2l_3 are negative, while l_3l_4 is positive. The important quantities are the lengths of these intercepts and the angle θ which the last locus line makes with the baseline B^1B.

The position of the last locus line is given by Ol_4 and may be written in the form $(Ol_1 - l_1l_2 - l_2l_3 + l_3l_4)$ or $(m_A \sec\beta - l_1l_2 - l_2l_3 + l_3l_4)$. Note that the intercepts must be read off in their *correct order*. Thus, starting from l_1, the first intercept is l_1l_2 and, being directed towards B, is negative; the second is l_2l_3 also negative. The last intercept l_3l_4 is directed towards B^1 and therefore positive.

What may be called the first equation is now written :—

$$(m_A \sec\beta - l_1l_2 - l_2l_3 + l_3l_4 + m_B) \tan\theta = -\frac{S_B}{\mu_B} = -\frac{S_B}{\mu_1}$$

giving S_B in terms of m_A and m_B and, therefore, of M_A and M_B.

The 2nd equation is

$$Pi_B + S_B = \frac{M_B - M_A}{l_{AB}} + R_B,$$ where R_B is the ordinary reaction at B due to the lateral loads, assuming pin joints at A and B and no end load. For example, if *w* were constant from A to B, and there were no concentrated loads, R_B would equal $\frac{w}{2} l_{AB}$. The last equation gives i_B in terms of M_A and M_B.

An exactly similar procedure is adopted for bay CB, which leads to an expression for i_B in terms of M_C and M_B.

Equating the two values of i_B (after changing sign) gives a relation between M_A, M_B and M_C.

Bay CB.—The diagram for this bay and the resulting equations are given without further comment, except to point out that the angle β will this time be assumed to be $> 90.°$

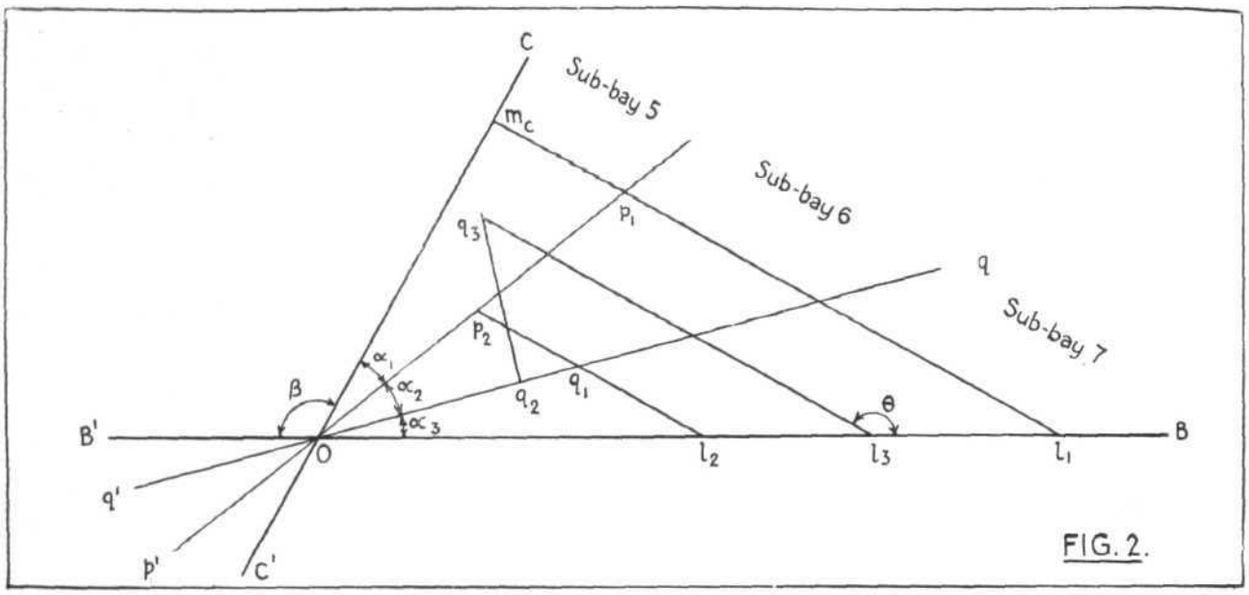


FIG. 2.

1st equation :—$(m_0 \sec \beta + l_1 l_2 - l_2 l_3 + m_B) \text{ ton } \theta = -\frac{S_B}{\mu_B} = -\frac{S_B}{\mu_2}$.

2nd equation :—$P i_B + S_B = \frac{M_A - M_B}{l_{BC}} + R_B$, where R_B is now calculated from the loading in bay CB.

If there were another bay CD to the left of C, the points D, C, B, would be treated in exactly the same way as C, B, A, have been, the total number of equations being equal to the number of unknown bending moments.

Assuming now that the values of M_A and M_B have been found by the above method, it remains to draw the bending moment diagrams. Bay AB will be taken as an example. For convenience these arcs will be called "loading arcs" and are marked k_1k_1, k_2k_2, k_3k_3 and k_4k_4 in the figure.

Suppose m_A + *ve* and m_B − *ve*. Lay off Om_A and Om_B along the + *ve* branch OA and the − *ve* branch OB^1 respectively. Draw perpendiculars at m_A and m_B to give locus lines ll_1 and $ll_4(1)$ respectively (a second ll_4 marked $ll_4(2)$ will presently be obtained). Having located point l_1, the points l_2, l_3 and l_4 are inserted in the same relative position, in so far as their order and distance apart are concerned, as in Fig. 1, thus avoiding a repetition of the construction there used. At these points draw locus lines ll_2, ll_3 and $ll_4(2)$ all parallel to ll_1. The point of intersection of $ll_4(1)$ and $ll_4(2)$ gives the apex X_4. At X_4 draw a $\|^l$ to h_3h_1 of Fig. 1 to cut ll_3 in X_3. At X_3 draw a $\|^l$ to g_2g_1 of Fig. 1 to cut ll_2 in X_2. At X_2 draw a $\|^l$ to f_3f_1 of Fig. 1 to cut ll_1 in X_1.

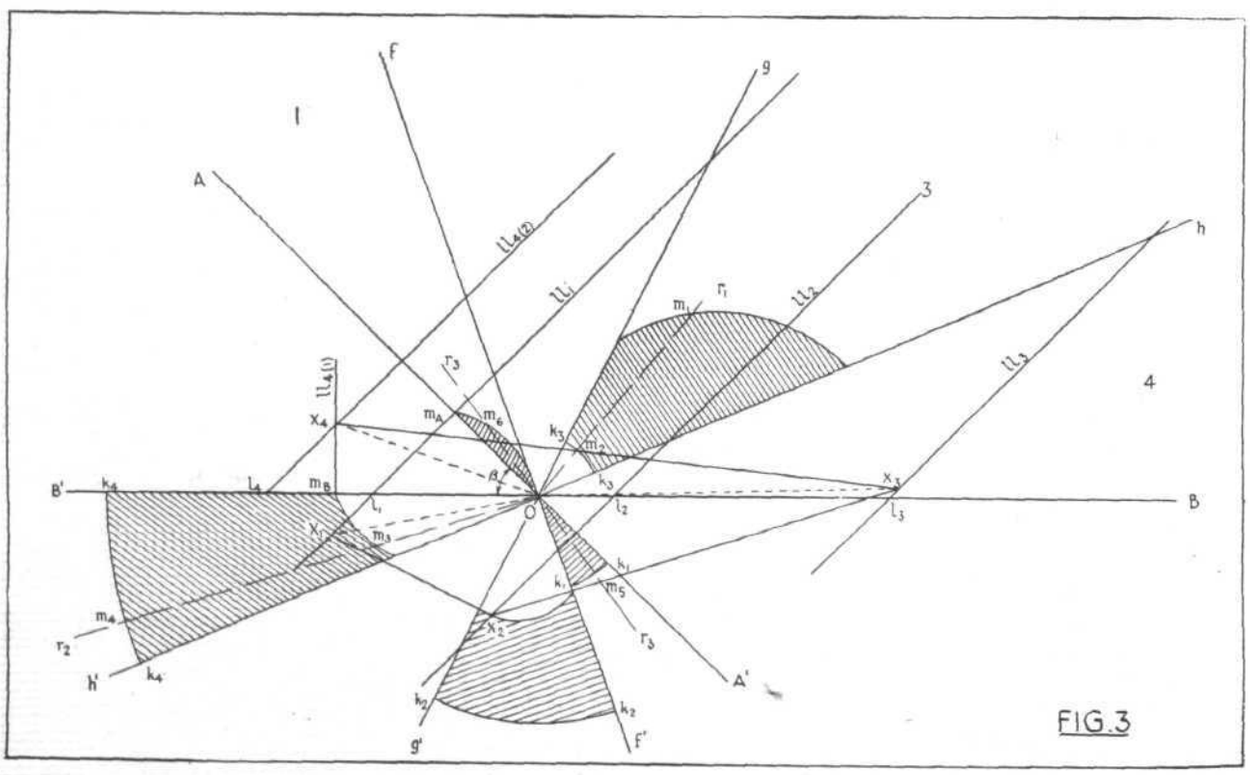


FIG. 3

Referring to Fig. 3, draw the boundary lines as for Fig. 1. With O as centre, draw in each sub-bay an arc of radius equal to the value of w/μ^2 for the particular bay (choosing a convenient scale, which will be retained throughout the remainder of the construction). If w is an up-load, the arc (contrary to what might have been expected) will be drawn in the negative sector; if a down load, in the + *ve* sector. With OX_1, OX_2, OX_3 and OX_4 as diameters draw circular arcs in the sub-sectors 1, 2, 3 and 4, respectively. It will be found that an arc will sometimes cut both the + *ve* and the

— ve branch of a sub-sector. For convenience of reference call these "cutting" arcs. The space between the loading and cutting arcs for any sub-sector is shaded as shown. If the cutting arc is above the loading arc ("above" meaning further towards the + *ve* branch of the sector) the moment is + *ve*; if below, it is — *ve*. Thus at the radius Or_1 in sub-sector 3, the moment m_1m_2 is + *ve*, as also are the moments m_3m_4 at the radius Or_2 in sub-sector 4, and m_5m_6 at radius Or_3 in sub-sector 1. To read the bending moment at any point in a sub-bay, all that is necessary is to convert the distance of the point from its nearest sub-bay boundary into angular measurement by multiplying by $57{\cdot}3\mu$ (if μ is variable its value for the particular point is taken), and then drawing a radius. The intercept on the radius made by the loading and cutting arcs gives the bending moment to the scale chosen.

The true shear at any point is obtained by first drawing the radius corresponding to the point, and then joining the point of intersection of the radius and the cutting arc to the apex X for that sub-sector. The length of this joining line multiplied by the appropriate μ gives the shear. If, looking along the + *ve* direction of the radius, the line is drawn to the right to meet the apex, the shear is + *ve*, while if to the left, it is — *ve*. The reactions at the supports are found in that way. As examples, we have

True shear at $Or_1 = m_1X_3 \times \mu_1$ and is + *ve* since m_1X_3 is drawn to the right.

True shear at $Or_2 = m_3X_4 \times \mu_1$ and is — *ve* since m_3X_4 is drawn to the left.

True shear at $Or_3 = m_6X_1 \times \mu_1$ and is — *ve* since m_6X_1 is drawn to the left.

(*To be concluded.*)

TECHNICAL FEATURES OF THE AIR MAIL.

By FRANK RADCLIFFE, B.Sc., A.M.I.A.E., A.R.Ae.S.

(*Concluded from p.* 14).

South America.

The development of air services in South America has been rapid during the last three years, and two American firms—Pan-American Airways and the "Nyrba" (New York, Rio, and Buenos Aires Line)—have now combined in an endeavour to capture as much of the South American trade as possible from their many competitors (see Map II). There are no British air lines operating in South America at the present time. Fuller particulars of these 18,217 miles of scheduled air routes, flying 80,868 miles weekly, will be found in FLIGHT, September 19, 1930. This consolidation of air lines is extremely interesting, and its developments in the future are worthy of careful notice. There is now a weekly air mail service to and from the principal U.S. cities and Buenos Aires and Montevideo.

West Indies.

Jamaica's first British Air Mail Service was inaugurated on December 10, 1930, and comprises part of a 33-hour air mail service between Jamaica and Montreal.

France.

There were four principal air-operating companies in France: Air Union, Farman Air Lines, Air-Orient and the Aéropostale. These have now been grouped into three systems:—

(1) *Eastern System*, with a contract extending over 30 years. The subsidies to this company are, 1930—£450,000; 1931—£600,000, with gradual reductions in subsequent years. Air lines extend from Marseilles to Italy, Greece, Syria, Iraq, Persia, Karachi, Calcutta, Burma, Rangoon, and on to Saigon in Indo-China.

The service Baghdad–Bangkok–Saigon is at present operating on a fortnightly time-table, and is reserved for postal traffic only.

The following is a list of the present charges per 10 grammes ($\frac{1}{3}$ oz.), in addition to the ordinary postage from France.

	Fr.	British. d.
France–Iraq	3	(3½)
„ –Persia	4	(5)
„ –India	5	(5)
„ –Indo-China and Siam... ...	6	(12)

In all the above cases, the British G.P.O., with its minimum of half-ounce letters, undertakes to carry letters under the existing air-mail service at an equal or slightly less expense from England. The actual surcharges are indicated in brackets, and the franc can be reckoned as twopence.

(2) *Continental System*, also with a contract extending over 30 years: the maximum annual subsidy being £391,220.

(3) *Western System*, divided into two subdivisions: the South American section, operated by the Aéropostale, and a new company for the African section. Both have contracts for 20 years.

In all the three systems, a share in the capital is held by the State. An interesting account of the technical aspects of the South American system is to be found in a paper by M. Grimault, published in the R.Ae.S. Journal for November, 1930, from which the following notes are taken:—

The French claim, for 1929, that on the route operating between Natal and Buenos Aires, the percentage of scheduled departures was 94, and the percentage of arrivals less than 48 hours late had been 82. On the Toulouse–Dakar section, the corresponding figures were 100 and 90 per cent.

The Atlantic crossing is made with boats at present, but soon it can be expected that flying-boats will be in service; then, Buenos Aires will be within five days of Paris.

In FLIGHT, May 16, 1930, will be found a description of the Lat 28-3 seaplane, which has been designed for the Atlantic crossing. It is a single-engined all-metal monoplane, fitted with a 600-h.p. Hispano Suiza, and has an all-up weight of 11,044 lb. and an empty weight of 5,720 lb. Cruising speed = 132 m.p.h., and range = 2,500 miles. This type of machine was exhibited at the recent Paris Aero Show. Another bigger type, the Lat 380, fitted with two Hispano Suiza engines of 650 h.p. each, in tandem, has been recently produced with a range of 2,200 miles. This is a flying-boat resembling, in many ways, Dornier types, as it has stub wing floats.

From the above brief account it will be evident that France is alive to the possibilities of air mail.

Germany.

Flying is done by the Luft Hansa, and very full details of Germany's air developments are to be found in two papers by Major Wronsky, read before the R.Ae.S., and published in the Journals for July, 1927, and October, 1930.

The past year has seen a condensing of the air lines in Germany, and many which were less important have been deleted. The following table indicates what Germany has been doing during the past few years:—

Kg.	1926.	1927.	1928.	1930.
Total mail carried	188,214	274,073	317,588	366,845
Total freight carried	258,464	641,186	1,023,206	1,198,790
Total km. flown	6,141,479	9,208,029	10,217,528	9,087,694

Holland.

(*See* Map III)

There are two sections of the Dutch air lines: K.L.M., operating from Holland as the base, and K.N.I.L.M., which operates in the Dutch-East Indies. A full account of the activities of these two services are to be found in two articles by Mr. M. Langley, appearing in FLIGHT for January 9 and 16, 1931. The Dutch service to the East Indies is proving a rival to the French line, which also goes to the Far East. Fokker aircraft are used exclusively, and it is interesting to note that they are all land 'planes. The Dutch air service is the most economically sound in Europe, for its subsidy is only 3 francs per kilometre, as against France, 17 francs; Germany, 14 francs; U.S.A., about 11 francs. British air lines receive the highest subsidies, about 20 francs on European Airways,

and 90–100 francs on Empire air routes. (*Manchester Guardian*, July 19, 1930, and FLIGHT Editorial for July 25, 1930.)

Possible Means of Progress and Development.

Our last task is to discuss, briefly, some of the problems which still await solution before air mails can be considered established services of international importance. The problems are not altogether peculiar to air postal service, but it is probably true to say that the air mail is the key to successful commercial flying, in all its aspects. Once we can establish air mail services as necessaries of life, then it will follow almost immediately that flying in all its aspects will be acceptable and desirable to all.

It is convenient to think of the problems under the following classification :—

(1) International agreements regarding spheres of activity.

(2) Development of right types of aircraft.

(3) Ground equipment and aids to safer flying.

(1) For any proposed new service to receive the general approval of people it is convenient to consider two requirements, at least, as being necessary. Firstly, the new service must do something better than any existing service, and secondly, it must make a very strong appeal to a big percentage of people. It is apparent at once that air mails certainly fulfil these two postulated conditions, for, if letters are sent by fast-flying long-range aircraft, important information in letters can be conveyed more quickly than by any surface means of transport and, in business, as time saved often is equivalent to money gained, business people will be attracted.

Map II.

If the proposed new service cannot be relied on, much of its attractiveness disappears and its appeal is removed. Again, if the conditions to be complied with in the new service are likely to prove annoying and irksome, the business man is inclined to disregard its otherwise good points. Thus, it appears to the writer that if air mail services are to be part and parcel of everyday life a generation hence, they will be such, only on account of and by virtue of their doing a service better than any other alternative method. Long-range wireless telephones and television are thus possible strong competitors with air mail services in the near future, and will need to be taken carefully into consideration.

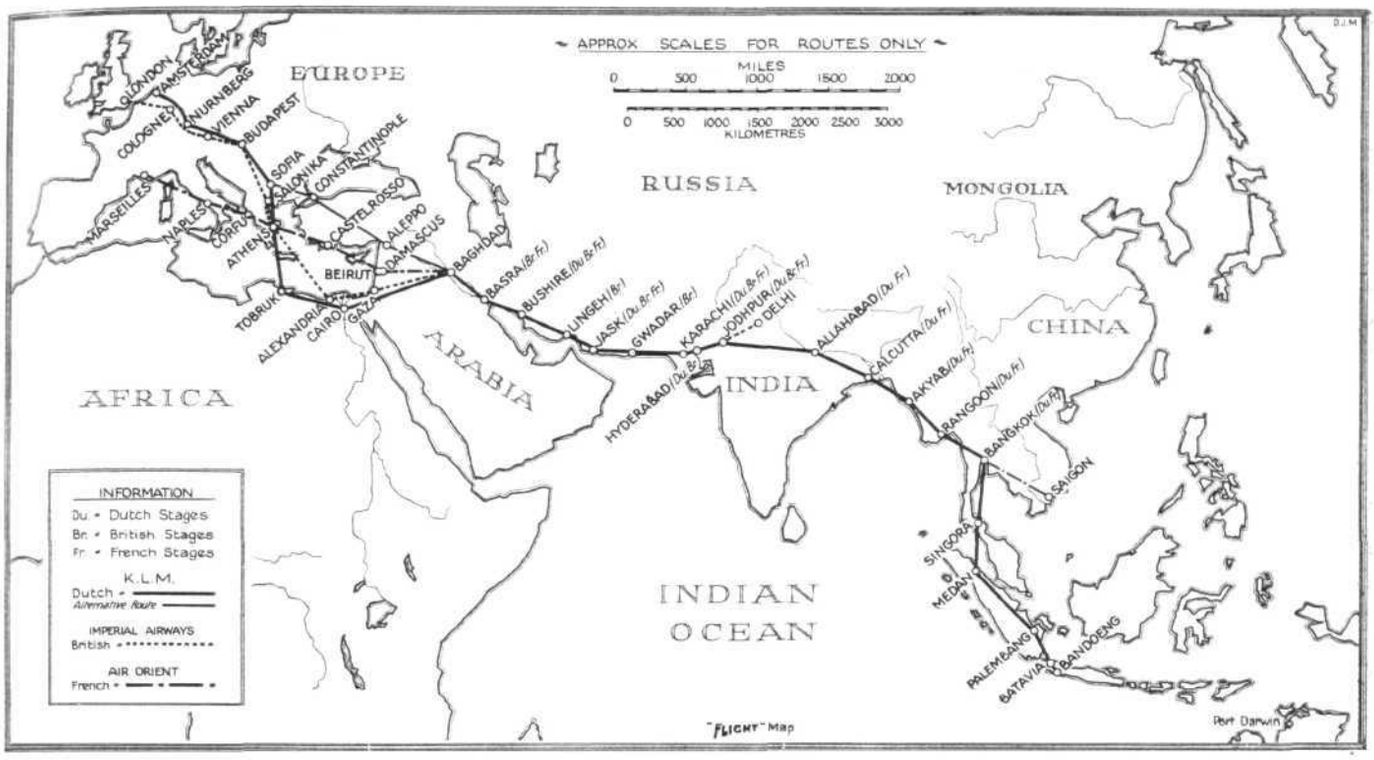
Some international co-operation seems, therefore, to be necessary for the regulation and best working of air mails, and the League of Nations is perhaps the best medium for this work. Not only will the regulations relating to air routes need drawing up, but working agreements will need to be decided upon to remove overlapping of routes in order that economies may be effected. Furthermore, the powers of the Postal Union will need extending so that uniform minimum rates can be charged for air mails.

(2) It has been remarked previously that what is needed first and foremost, today, in air mail services is *dependability* and it is believed that the R.A.F. could assist the civil side of aviation very considerably by making known to all concerned the important lessons derived from the long-distance cruises that are frequently made by groups of aircraft. Information regarding installation breakdowns, power-plant defects, and other factors adversely affecting reliability, accessibility and easy maintenance would enable special attention to be paid to their elimination in future aircraft. In this way the civil expenses incurred on such long-distance flights could be reduced by making these experimental cruises part of Service exercises.

One field of inquiry which is ready for careful investigation and which would yield invaluable data would be the regular patrol of big flying-boats of a 2,000 miles non-stop stage. This would call for special flying boats that could be utilised on several sections of Imperial air routes. The approximate requirements would be for a multi-engine flying-boat having a range of 2,200 miles and carrying a useful load of at least 1,000 lb. at a cruising sped of 150 m.p.h. With the successful development of such a flying-boat the Trans-atlantic Service becomes an attractive proposition to all commercial firms.

The following passage taken from Major Wronsky's paper in the R.Ae.S. Journal for October, 1930, seems apposite, for it shows how alive to the problem are our German commercial competitors, and, incidentally, if we allow the opportunity to pass by, how great will be the struggle for us to get even a fair percentage of the trade :—

". . . We place first, the extension of the aerial post and goods traffic, as without doubt, very shortly the aerial post will give the biggest opportunities for solvency of intercontinental traffic. Under present conditions, and those of the near future, one should not be too optimistic about the possibilities of trans-oceanic passenger traffic. The comfort in the aeroplane, even in five or ten years' time, due to the limited space, will not compare with the luxurious arrangements of our ocean giants—a question which is more important with ocean journeys than with land, and will draw the wealthy travelling public first to the steamer. To me, therefore, it seems more important to give attention the the building of capable freight and postal aeroplanes for the trans-Atlantic traffic, and then to work for the passenger traffic. If we consider that 80 per cent. of the total world trade crosses



Map III.

the Atlantic ocean, I believe that my arguments cannot be ignored. In Germany alone and its neighbouring States (Central Europe), the daily despatches of letter post for North America amounts to about 2,300 kg., for South America to about 500 kg., and for East Asia (Japan and China), 200 kg. In one year between Europe and Asia about 800 tons of letter post were forwarded (according to Pirath). Add to this the very heavy freight service to these world centres, the solvency, due to such quantities, would be much easier than the passenger traffic, even if only one-third is carried by the air service. To accomplish this as already mentioned, an absolutely reliable, capable and fast freight aeroplane, which we do not possess to-day, anywhere, is necessary."

These remarks of Major Wronsky are worthy of the reader's very careful consideration. The Dornier Do.X. may be regarded as an attempt to supply such a craft, and the proposed new Supermarine 6-engined flying-boat may be regarded as the British reply. A comparison of the two will be extremely valuable when the data are available.

With landplanes there is plenty of scope for improvement, and until engine units are even more dependable than they are at present, aircraft employing three or more engines will be necessary for most Imperial routes. Multi-engines affect the aerodynamic efficiency and maintenance of an aeroplane adversely, but they enable one to disregard, almost entirely, the possibility of a forced landing. Thus they can operate at higher landing speeds, due to the elimination of need to land at intermediate aerodromes of small area. The increase in the landing speed will give an appreciably higher cruising speed to the mult-engine aircraft, that helps to counterbalance the reduced aerodynamic efficiency.

(3) The problem of "blind" flying has been mentioned in a previous article, and it is interesting to note the research work which is being steadily pursued in different parts of the world. A recent paper by Mr. Meredith, of the R.A.E., gives an excellent résume of the present position of developments, and for a fuller account of what has been done in the U.S.A. the reader is recommended to study the Guggenheim Bulletins on "Solving the Problem of Fog Flying."

There appears to be no doubt, however, that wireless beams and light beacons can both play a very important part in helping on long-distance flying over regular air routes, and anything that will accelerate their installation will react very favourably on air mail development.

The adoption of "Automatic Pilots" on big, long-range mail 'planes will relieve the pilots and might even enable one pilot to be carried in place of the usual two.

The perfecting of means which enable a 24-hour flying day to be practicable will bring many advantages that have been mentioned previously and should, in addition to saving time, save in ground staff charges.

In conclusion, the writer would like to add that he is confident that international air mail services will be everyday facts for the next generation, but that their development will not be quite so rapid as many would have us believe. The importance of their service and the international character of their operation are two factors which, in themselves, will require the most careful thought to be given to all future proposals.

TECHNICAL LITERATURE

UNTERSUCHUNGEN ÜBER DAS KLOPFEN VON VERGASERMOTOREN.

(Investigation into the Knocking of Carburettor Type of Engines.)

By DR. ING L. AUER. Forschungsheft 340 (Supplement to "Forschung auf dem Gebiete des Ingenieurwesens—Investigation in the Engineering Field). Edition B, Vol. 2, January, 1931. VDI-Verlag G.m.b.H., publishers. DIN A4, IV, 18 pages with 24 illustrations and 12 tables. Price each R 5.

The phenomenon known as "knocking" or "detonation" has been known for a long time, but is still proving a serious obstacle in all attempts to increase the economy of engines fitted with carburettor.

Two scientists were pioneers in the investigation of this phenomenon, Ricardo designed a test engine with variable compression, while Midgley invented "anti-knocking medicines." The results of the work of these two and many others in the same field were collected and form the first section of this volume of research.

The second section of the booklet contains a report dealing with the experiments made by the author with the aim of throwing light on the questions: "Which are the causes of knocking and when will knocking take place in an engine?" A new instrument was designed for measuring the force and determining the time of the shock caused by the knocking

relative to the dead centre of the stroke. This instrument, which is described in detail, is an acceleration device of the style of the Midgley indicator re-acting on the acceleration caused by the shock of the knock.

These investigations were carried through with the same fuel under variable conditions of the engine. The results were plotted in charts from which important conclusions may be drawn: For instance, at no period before the piston reached dead centre did knocking occur. The attempt to produce the effect of knocking by varying the time brought the engine to a standstill. Force and time of knock are dependent on each other, the force being all the greater the closer the dead centre is approached.

In the third theoretical part of the volume the results arrived are compared with those found by Brown and Watkins. Proof is furnished for the opinion of these two investigators that the speed of the pressure increase divided by the temperature of spontaneous ignition forms a scale for the resistance of a given fuel against knocking.

The importance of these investigations is enhanced by the fact that pursuing the ideas expounded an instrument may be designed by which the degree of immunity against knocking inherent to fuels may be determined.

This report on research is added to the B edition of the journal "Forschung auf dem Gebiete des Ingenieurwesens" (Research in the Engineering Field), Vol. 2, Jan., 1931, but may also be bought separately.

SUMMARIES OF AERONAUTICAL RESEARCH COMMITTEE REPORTS

These Reports are published by His Majesty's Stationery Office, London, and may be purchased directly from H.M. Stationery Office at the following addresses: Adastral House, Kingsway, W.C.2; 120, George Street, Edinburgh; York Street, Manchester; 1, St. Andrew's Crescent, Cardiff; 15, Donegall Square West, Belfast; or through any bookseller.

AN EXPERIMETAL DETERMINATION OF THE INTENSITY OF FRICTION ON THE SURFACE OF AN AEROFOIL. By A. Fage, A.R.C. Sc., AND V. M. Falkner, B. Sc. R. & M. No. 1315. (Ae. 470). (24 pages and 14 diagrams). April, 1930. Price 1*s.* 3*d.* net.

The principal part of the present investigation is concerned with an experimental determination of the intensity of friction on the surface of an aerofoil from the well-known relation $f = \mu\ (\partial V/\partial z)_{z=0}$, where f is the intensity of friction, μ the coefficient of viscosity, and V the velocity parallel to the surface at a normal distance z from the surface. In general, the velocity changes rapidly near the surface, so that the velocity gradient $(\partial V/\partial z)_{z=0}$ can only be predicted reliably when the velocity observations are taken very close to the surface.

A review of the instruments available for the measurement of the velocity very close to a surface led to the conclusion that the most suitable device would be a surface tube of the type designed by Sir Thomas Stanton, and used to examine the conditions at the boundary of a fluid in turbulent motion.* The special feature of this tube is that the inner wall of the tube is formed by the surface itself. Three surface tubes were used in the present experiments, and the observations taken with them were found to be mutually compatible and allowed predictions to be made of the velocity gradients at the surface, and so of the frictional intensities.

A check on the general accuracy of these values of frictional intensity was obtained from a comparison of the resultant frictional drag of the aerofoil predicted from them, with that obtained when the form drag due to the normal pressures on the surface was subtracted from the total drag deduced from the total head losses in the wake. It was found that the velocities measured near the surface with these tubes were compatible with those measured still closer to the surface with the surface tubes. The frictional drag of the aerofoil was also determined from the changes of momentum along the boundary layer.

* "Proc. Roy. Soc.," A, Vol. 97 (1920). By T. E. Stanton, Miss D. Marshall and Mrs. C. N. Bryant.

A SIMPLIFIED ANALYSIS OF THE STABILITY OF AEROPLANES. By W. L. Cowley, A.R.C.Sc., D.I.C., and Sylvia W. Skan. R. & M. No. 1333 (Ae. 465). (13 pages.) March, 1930. Price 9*d.* net.

Although many mathematical investigations have been carried out from time to time upon the stability of the aeroplane, it is doubtful whether the work has received much direct practical application. Modern machines are generally designed without the aid of the complete theory by the application of some simple features that have received academic treatment, and whose general advantage has been confirmed by experiment.

The present report gives a simplified analysis of the stability of aeroplanes for straight line flight. In addition, the present position with regard to the effect of lag upon the rotary derivative M_q is examined. It is concluded that *in the case of automatically controlled machines it may be necessary to* include the acceleration derivative $M_{\dot{w}}$ in stability analysis, and it is suggested that experiments be made to determine the magnitude of this derivati and the correction to be applied to M_q.

DIRECTIONAL STABILITY OF HIGH-SPEED AIRCRAFT. By W. G. Jennings, B.Sc. Communicated by the Director of Scientific Research, Air Ministry. R. & M. No. 1340 (Ae. 472). (4 pages and 17 diagrams.) May, 1930. Price 6*d.* net.

It has been reported that some high-speed aircraft are directionally unstable when flying at small angles of incidence, and it was considered desirable to investigate the problem of directional instability from a practical point of view, since, although from time to time theoretical analyses of the subject (*e.g.*, R. & M. 1077*) have been made, no systematic investigation by flight tests has heretofore been carried out.

The azimuth and rudder angles of a Hawker "Hornbill" aeroplane flying at high speeds were measured. The tests were carried out by serveral pilots using various conditions of rudder cable rigging and rudder hinge friction.

The ability to maintain a straight course with this aeroplane flying at high speed is largely a matter of the pilot's skill and experience. With due care and experience it is possible to control this aircraft so that the maximum deviation from the mean direction of flight is less than 2°.

Within the range covered by the tests the conditions of the rudder cable rigging and the rudder hinge friction have no appreciable effect on the control.

* R. & M. 1077. Lateral stability with special reference to controlled motion. H. M. Garner, M.A.

FULL SCALE DETERMINATIONS OF THE MOTIONS, AT THE STALL, OF A BRISTOL FIGHTER AEROPLANE WITH SLOT AND AILERON CONTROL ON BOTH PLANES. By K. W. Clark, B.Sc., D.I.C. Communicated by the Director of Scientffic Research, Air Ministry. R. &. M. No. 1341 (Ae. 473). (7 pages and 21 diagrams). May, 1930. Price 9*d.* net.

These experiments continue the investigation of the behaviour of aeroplanes at large angles of incidence when certain controls are applied. Previous reports have dealt with a standard Bristol Fighter (R. & M. 1181),* a Fokker F.VII 3M monoplane (R. & M. 1228),† and an Avro 504 N (R. & M. 1263).‡ The flying for the results shown was carried out between June, 1929, and January, 1930.

A Bristol Fighter aeroplane fitted with slot and aileron control on the top and bottom planes was used. The motions of the aeroplane, together with the angles of incidence and side-slip and the movements of the controls, when certain controls were applied at two initial incidences, were recorded photographically.

Below and above the stall the lateral control produces a rolling moment of the right sign, but above the stall it is not always powerful enough to reverse angles of bank over 60°. A considerable amount of yaw results from any attempt to reverse the rate of roll beyond the stall. The rudder appears to lose no power at the stall and is effective in reversing the rate of roll and yaw at both incidences.

* R. & M. 1181. Instrumental records of the lateral motions of a stalled Bristol Fighter aeroplane.—B. M. Jones and Flight-Lieut. Maitland.

† R. & M. 1228. Full-scale control tests of Fokker F.VII 3M monoplane.—J. K. Hardy.

‡ R. & M. 1263. Full-scale determination of the motion of an Avro aeroplane when stalled.—K. W. Clark and W. G. Jennings.

SMOKE EXPERIMENTS ON AN AEROFOIL WITHOUT AND WITH SLOT. By T. Tanner, A.C.G.I., D.I.C. Communicated by Professor L. Bairstow, C.B.E., F.R.S. R. & M. No. 1352 (Ae. 483). (2 pages and 24 diagrams). July, 1930. Price 1*s.* net.

Following experiments by J. J. Green,* at the Royal College of Science, which illustrated the reversal in the direction of the airflow in the boundary layer behind the point of break-away in the cases of the circular cylinder and a thick aerofoil, an investigation was carried out, with the aid of smoke on the upper surface of the symmetrical aerofoil R.A.F. 30. The object was to determine whether reversal of flow occurred in the case of an aerofoil of normal section, and, if so, to get some idea as to the extent of the region of back-flow.

From the results in general it appears that a stationary vortex is formed just behind the breakaway of the boundary layer. Behind this vortex others are also formed, but they break off from the surface and travel downstream, forming the eddying wake behind the aerofoil.

* R. & M. 1313. The viscous layer associated with a circular cylinder.—J. J. Green.

FULL SCALE MEASUREMENT OF LIFT AND DRAG ON BLACKBURN "IRIS." By L. P. Coombes, B.Sc., and R. K. Cushing. R. & M. No. 1354 (Ae. 485). (5 pages and 5 diagrams). May, 1929. Price 6d. net.

Gliding tests are a part of the type trials of new aircraft, and, with slight elaboration, these tests will yield the necessary data for the calculation of lift and drag. The chief difficulty lies in the correction to be applied for the drag of the airscrews unless they are stopped. Airscrew stopped glides are not always practicable on large seaplanes, so that any accurate method of measuring lift and drag with the airscrews rotating is advantageous.

The method consists in gliding with the engines throttled so that the airscrews are running at zero thrust, and a device for indicating when this condition obtains is used. Experiments were made on Blackburn "Iris II" and glides at zero thrust, and with the engines fully throttled were effected.

The difference in lift between gliding with airscrews rotating at zero thrust and with engines fully throttled is marked, but the principal effect is, of course, observed in the drag measurements. Good agreement with model tests was obtained. The drag of the windmilling airscrews was deduced. It is proposed to check the method by further full scale and model experiments and if the method is sound, to use it for measurements of lift and drag of other large seaplanes.

AIR TRANSPORT

NIGHT AIR MAILS

By CAPTAIN CARL FLORMAN

(*Managing Director of the A.B. Aerotransport, Stockholm.*)

(*Concluded from p.* 259)

LET us now try and investigate what economic prospects exist for organising the night air mail lines suggested here. The question is looked upon from different points of view in the different countries, *e.g.*, Germany has adopted the system that the German Post Office pays the German Luft Hansa for the trips made, instead of the transit income received from foreign post offices. The German Post Office thus charters the mail planes from the German Luft Hansa and pays a certain fee per kilometre.

Another method is that in use in the Scandinavian countries, viz., for the mail to be paid for according to the Hague Convention, 6 gold centimes per 100 grammes and 100 kilometres, with a certain guaranteed weight, which weight, however, pretty closely approaches the mail quantities actually carried.

The third method of arranging the economy of the night air mail services is to bring these flights under the other State-aided flying, *e.g.*, such as is the case with the Sabena's night air mail line between London and Brussels.

Whether the development of the night air mail service will be economically secured by the post offices chartering aeroplanes for the conveyance of mail, as in Germany, or by paying according to the Hague Convention, but with a certain guaranteed minimum weight (the method adopted by the Scandinavian countries), or by direct State subsidy as in Belgium, will have to be decided by the different countries. Whichever of these three schemes is adopted, the expenses for the respective countries will, on the whole, be the same for each kilometre flown, since in any case the bulk of the expenses for carrying on the flights must be defrayed from public money, inasmuch as the airways companies, within the next few years, will probably not be able to expect any income from passengers on the night air mail lines, and only some part of the operating expenses can be covered from income derived from freight.

Of the three different methods for economically securing the night air mail services, I consider, however, the one adopted by the Scandinavian countries to be the best, since it is not merely the most business like, but also the most advantageous from a public point of view, for by sending along all first-class mail, the load-carrying capacity of the aeroplane is fully utilised, and the whole nation gets the benefit of the more rapid mail service.

The four Scandinavian Post Offices consider that as the holders of monopolies for mail conveyance they should not only benefit from such monopolies but also be obliged, out of consideration for the correspondents, to utilise every chance offered, and which is not economically insurmountable, for the purpose of bringing about an increasingly rapid mail service. For this reason the Swedish Post Office began several years ago to send along, by way of trials, with the ordinary day 'planes, which leave Malmoe in the morning after the arrival of the night mail train from the north, not only air mail but also first class mail *without an air mail fee*. After the Swedish Post Office had discovered that the regularity attained in daylight flights had been perfectly satisfactory, they increased from year to year the conveyance of first class mail by aeroplane without an extra fee, so that the Swedish air lines now carry practically all such first class mail to European countries, which is, of course, delivered much earlier.

I would suggest that the method adopted by the Scandinavian countries for the economic performance of the night air mail service be generally adopted in Europe.

This night air mail conveyance of first-class mail without air fee has also to a large extent been brought about in the conveyance of mail to Great Britain, but has there not been fully understood or appreciated. The four Scandinavian countries, as well as Germany, Belgium and Switzerland, which by making economical sacrifices, have improved the mail service to England, have discovered to their astonishment that this improvement was not looked upon with favour by the English Post Office, which in a memorandum addressed to the other Post Office Authorities commented unfavourably upon this gratuitous and rapid conveyance of mail to England. However, the Postmaster-General, although rather unwillingly, has now consented to take delivery of this aeroplane post, although he seems to have omitted to take such measures for the conveyance of the mail bags to and from Croydon Aerodrome and the local post offices as are necessary for ensuring the full benefits of an aeroplane mail. Thus no fewer than three hours have been required for this local transport in London, or approximately as long as it has taken to fly from Amsterdam to Croydon.

At the Air Mail Conference held in Brussels last autumn, a proposal was even submitted by some countries, including England, to the effect that the receiving Post Office might *forbid* the conveyance by aeroplane of any other mail but air mail. This proposal was not adopted, but the conference granted to the despatching countries the right to forward first-class mail by their air lines without air fee, when such is deemed suitable.

What difficulties exist then from a British point of view to adopt the same method as that which with advantage has already been tried by other countries, and which all and everyone will acknowledge to be the future means of conveyance for the mail?

If we look upon the question first of all from a postal technical point of view, it must be said that hardly any country in the world is in a more fortunate position than England. Practically all conveyance of mail to and from the Continent is concentrated upon a single spot, London, whereas the majority of the other countries have several points of issue. It will, therefore, be remarkably easy to despatch from Croydon, and receive there, all inward British Continental mail.

The economical side of the question in so far as England is concerned, is not so very important.

According to a statement made recently by the Postmaster-General to a deputation from the British Chamber of Commerce, the British Post Office during the year 1929 had a surplus of £9,000,000. Yet only a fraction of this sum would enable the British Post Office to follow the example of the Continental Post Offices in respect to the conveyance of mail by aeroplane. Such a grant would still further consolidate England's position in the world of commerce.

Estimated annual cost for conveyance by air of all English first-class mail to the European Continent, with the application of the bases of payment adopted by the Hague Convention, 6 gold centimes per 100 g. and 100 km.

I have tried, in the table on the next page, to estimate the annual costs for the conveyance of all first-class English mail by aeroplane to the European Continent. The estimates of weights have been based upon official international statements of the *number* of postal packets during the year 1928, and in assuming that these, as in the majority of countries, on an average weigh 10 grammes each, I therefore estimate that Great Britain sends about 700,000 kg. of first-class mail per annum to the European Continent, and that, if *all* such mail were conveyed by aeroplane, both by night and by day, all the way, the annual expenditure would be approximately £166,000.

It should, however, be noted that the actual costs would be much lower, for, firstly, there cannot be any question of carrying by aeroplane any other mail than such as, by so doing, reaches its destination much earlier, and secondly, the land and sea transit charges otherwise paid to the Post Offices of intermediate countries are saved, and thirdly, there do not as yet exist from a time-table point of view suitable air lines throughout the year to all countries.

Destination	Estimated weight in tons per annum	Estimated average length of conveyance in miles	Payment in £ per annum estimated according to the Hague Convention
Finland	6	1,430	3,285
Sweden	20	930	7,135
Norway	16	1,060	6,470
Denmark	21	750	5,995
Russia	3	1,740	2,000
The Baltic States ..	6	1,240	2,855
Poland and Danzig ..	8	930	2,855
Czeckoslovakia ..	13	930	4,640
The Balkan States	23	1,800	15,865
Hungary	5	1,120	2,140
Austria	15	930	5,350
Germany	150	560	32,115
Italy	52	990	19,790
Switzerland	44	500	8,375
The Netherlands ..	71	310	8,445
Belgium	56	250	5,330
Spain	29	990	11,040
Portugal	12	990	4,570
France	150	310	17,840
Total, tons ..	700	Total	£166,095

The bulk of the outward bound British mail could be carried by *British aeroplanes* to Cologne for transfer to other lines. A large portion of the British Post Office's expenses would thus be paid to an English airways company.

Before I pass on to the technical side of the question, I wish only to mention by way of comparison that during the year 1930 only 30 tons of mail were despatched by aeroplane from England to the European Continent, whereas during the summer months of 1930 no fewer than 65 tons were despatched from Sweden. It may also be of interest to note that 3½ million postal packets were despatched from Switzerland in the course of last year, not even one-tenth of these having paid an air fee.

I have here a slide (Fig. 8) which shows the daily despatches in kilos to and from Scandinavia by the different night air lines last summer. You will see from it that the night air mail *from* Scandinavia was remarkably large, whereas the mail *to* Scandinavia was trifling, and that on an average we sent 184 kilos per trip to London, but did not receive a single kilo *from* London.

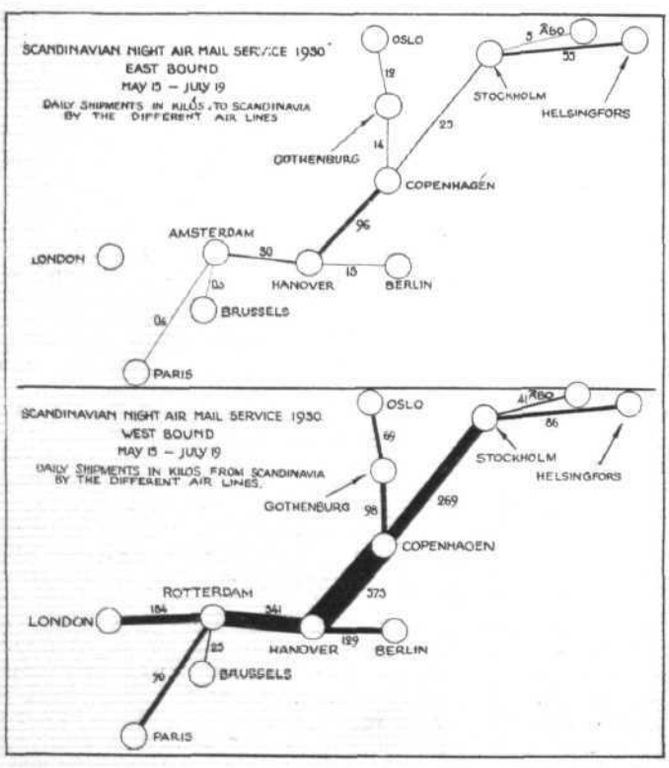


Fig. 8.

The scheme for Inter-European Night Air Mail Traffic such as I have outlined, necessitates an investigation of the technical aspects into the possibilities of maintaining regular night-flying services.

Severe demands have obviously to be made upon the staffs both of mechanics and the aerodrome personnel, as well as upon the aeroplanes used. I shall now try and touch upon the main features of these problems, regardless of whether they have already been solved or still have to be solved, or are even now in the process of solution.

Night Flying

Owing to the immensity of my subject I regret that it is impossible to deal with it extensively this evening. Nevertheless, I would like to give you in the time at our disposal, my own ideas about night-flying and which I have based upon American, Belgian, French, German and Swedish experiences.

Regular night-flying calls for tremendous physical and mental qualifications on the part of pilots. I am personally convinced that not more than 50 per cent. of the pilots at present engaged by the European Aero Services are suitable for this task. It must be from the younger men, who by virtue of their more up-to-date training are better qualified, that we are to obtain our recruits for this class of flying.

Unfortunately, when it is a case of " flying blindfold " our own sense of balance is absolutely useless to us. It even acts as a direct hindrance under certain conditions. Thus, as soon as the pilot loses his power of vision in the fog or darkness, he must be fully capable of navigating entirely by means of instruments, and furthermore be confident that he can do so without fear of making any error which might prove fatal. It is just this thought which frightens the still inexperienced pilot, who under certain circumstances can occasionally be subjected to great mental strain and worry. There is no middle-way between ordinary vision-flight and flying " blind " or " instrumentally." Many otherwise clever pilots have crashed with fatal results through imagining that there was.

We may say unhesitatingly, although with a certain amount of reservation, that reliable instruments are now available for the accurate navigation of aeroplanes flying " blind." Naturally the suitability of the individual types of machines must be taken into consideration in this connection. There must be a certain amount of inherent stability in an aeroplane to render the pilot's task easier and give him a chance of finishing the flight safely, especially during squally weather.

Instruments

A fundamental condition for " blind-flying " is an instrument which records the stability of the aeroplane round its horizontal and longitudinal axis and also its vertical axis of elevation. All modern instruments designed for this purpose are on the gyroscope principle and cardan pendular suspension. Gyro horizon indicators and turn and bank indicators are distinguished by different structural details, of which there are several combinations. Many of the different makes are very reliable, but it would appear that the most suitable and preferable manner of propelling the gyroscope, which is so important for the proper operation of the instrument, is a detail to which utmost attention must be paid.

Pitot and venturi tubes are subject to perturbation as a result of water percolating into them or else as the result of ice forming in them. In the latest tubes there are electric heating devices. Other designs have an electric drive attached to the gyroscope.

In order to achieve an exact stability in the course of the flight, inventors and aeroplane designers are working hard to find some device for making lateral steering possible, and which device could be automatically operated or influenced by any deviations from the set compass course of an aeroplane. Trials made with new designs have proved promising.

It may be said that the following instruments are necessary for " blind-flying " equipment : A horizon indicator, a turn and bank indicator, a longitudinal inclinometer, a rate of climb indicator, airspeed indicator, a compass and a reliable altimeter.

Even supposing that reliable instruments are available so that starting and perfectly safe flying in fog and darkness may be undertaken, safe landing without being able to see the ground is as yet, however, practically impossible. An altimeter which shows the exact height at which a machine is flying above the ground, does not exist. Altimeters based upon barometric pressure of the atmosphere are not, even with their extremely sensitive devices for correction and adjustment, so accurate that they can be considered as reliable instruments when landing. The echo-plummet used

extensively for maritime navigation seems to encounter certain difficulties in aeroplanes. On the other hand, the trials proceeding in America with a radio-sounder have been successful and appear to promise good results. Another factor of uncertainty, which apart from the determination of altitude, adds to the difficulty of making a " blind " landing, is the difficulty of determining the exact position and size of the aerodrome. Even here we might be able to rely upon wireless to get a satisfactory result. The pilot could, either through picking up verbal signals with his headphones or visually with the aid of some instrument, glide down towards the end of the aerodrome in a kind of " tunnel " through space, which could be both horizontally and vertically outlined to him by means of wireless messages.

As will be seen from the foregoing, there are numerous difficulties still to be overcome before " blind " landing can be made safe, in conjunction with the now possible " blind " starting and flying. As soon as this is achieved scarcely any atmospheric conditions can any longer act deterrently upon air traffic.

Beacons for Night Landing

In order to enable safe landing at night the aerodromes must be equipped with complete illumination for night landing. The demand for the necessary flood of light, minimum expenses for operation and upkeep, as well as the utmost possible reliability, means that only an electrical plant can be taken into consideration for this purpose. The main parts necessary for such a light installation are :—

Aerodrome Lighthouse.—With a light of such a character as to enable the identification of the aerodrome. For this purpose the most suitable aid are powerful electrical intermittent flash light beacons. The lamps should be about 1,000 watt strong.

Obstruction Lights.—These are erected on all obstacles, existing in the vicinity of the aerodrome, as well as on hangars, wireless masts, etc. These beacons should show a red light either fixed or intermittent. Strength of lamps about 300 watt.

Boundary Beacons.—To be placed along the borders of the aerodrome at intervals of 300 to 500 ft. from one another. These beacons should show a light whose colour differs from that of the obstacle marks. Sweden has adopted a chrome-yellow tint. Strength of lamps about 200 watt.

Wind Indicator, with illuminations, is set up at some suitable free spot close to the aerodrome, where it cannot be affected by local interferences in the direction of the wind.

Flood Light.—For illuminating the surface of the aerodrome on landing. For a large aerodrome of about 1,000 yards diameter, six flood-lights, of at least 10 kw., uniformly placed round the aerodrome, will be required. When in use two aggregates are always lighted with one unlighted aggregate between them, by which means consequently the pilot, on landing or starting, gets the light obliquely from behind on both sides. By this means, all dark shadows on the aerodrome, and also part of the risk of dazzle, which is greatest with illumination from one point only, are obviated. The source of light, which, according to local conditions, should have a horizontal spread of 90° to 150°, and may either be collected in a joint lens or distributed amongst several searchlights, shall have a focal height of at least 3 m. above the ground, not only for being able to get sufficient vertical illumination of the ground, but also to enable efficient screening of the light upwards, so that it cannot interfere with the pilot on making his landing. The vertical spread of the flood-light should not exceed 3°. The great power of light is absolutely necessary in order that the flood-light under critical circumstances with poor visibility may be capable of being moved to serve its purpose.

Front Illumination of hangars or other large free-standing objects, so that their figure of space is distinctly marked. This is necessary in order to enable the pilot, before landing, to get an opportunity to control and adjust his eyes, for after a prolonged stay in darkness there is a tendency of losing stereoscopic vision, and in doing so, also the capacity to judge distance.

In Sweden there is at present being erected a night landing illumination plant at the Malmoe aerodrome, Bulltofta, on the lines I have mentioned here.

For navigation along the night air routes between the different aerodromes, the pilot must not only have available wireless connections, to which I shall revert later on, but also beacons. Opinions differ very much in respect of the most suitable organisation of a night air route. In certain circles beacons are considered unnecessary, in others necessary, and it is only with regard to the use of wireless that opinions coincide.

Beacon Air Routes.—A more thorough study of all the factors determinative for regular traffic goes, however, to prove that beacons must be looked upon as necessary, and also a system of emergency landing places. Blind flying is certainly now possible, but making a blind landing is as yet unsolved ; blind flying under all conditions calls for experience and routine which tell us that we should not, *a priori*, look upon it as the normal method of navigation ; reliability of the navigation instruments and the aeroplane engines are great and grow better and better, but hardly reach 100 per cent. ; moreover, it is desirable that the night air routes should not only be practicable for the trained pilot, but also for all other civilian flying activity, etc.

The strain in blind flying is still so great that the regular night pilot needs those opportunities for control of his instruments which can be afforded to him by beacons or other landmarks on the ground with clear vision. He has on these occasions a chance of strengthening his trust in his instrumental equipment on board his aeroplane, which can only fortify his moral power and endurance for worse weather conditions, and not *vice versa*, as has been advocated from several quarters. A real night pilot knows that, as I have previously pointed out, there is nothing intermediate between flying by sight and flying by instruments, but either one or the other. Likewise that difficulties encountered after having started on a flight can hardly be avoided by turning, but that the completion of the flight depends upon his conscious trust in the instruments he has on board.

We may assume that the occasions when the pilot, on account of stormy, squally weather is forced to make an absolute blind or chance flight are just as many as when blind flight becomes necessary by reason of deficient vision. Blind flying in squally weather causes a far greater strain than flying in a fog, and has also with absolute certainty its limit in the event of no beaconed route or the like being able to give the pilot a chance to unbroken control of his navigation. Blind flying is a form of navigation which with all certainty can, and should, be carried out when such becomes necessary for purposes of regularity, but it should not form the foundation of the safety organisation which a beaconed route is in need of for regular traffic.

The main principles for the establishment of a night air route, I consider, must be : as *straight* a route as possible between the respective aerodromes ; emergency landing places not more than 50 miles apart ; beacons not more than 15 to 20 miles apart ; wireless organisation which enables safe connection with the pilot, no matter where he may be along the route ; wireless direction finding in the shape of taking the direction of the position or course from the ground stations as well as wireless beacons, where such is found necessary ; and meteorological service organised in view of the general meteorological conditions along the air route.

Emergency Landing Places

The emergency landing places, which should be located close to the air route and have the most favourable location possible for entering them, should extend to something like 600 m. in the directions of the wind mainly prevailing. As regards night illumination, they might be provided with landing beacons, obstacle beacons, border lights, wind indicator, and cloud altimeter. As a matter of principle there should be stationed a meteorological observer at every emergency landing place. As a general rule it holds good that in the establishment of aerodromes they should be placed as high and open as possible, and that no place in a depressed position should be chosen.

Beacons : their Design, Construction and Location

As beacons along air routes the rotary, electrical types have proved their usefulness and suitability. Gas beacons do not give off a sufficiently powerful light, and are also much more expensive in operation and upkeep, for which reason they should only be made use of in such places where an electrical plant is out of the question economically. The location of beacons as a matter of course depends upon local conditions, but the source of light should be so high above the ground that it affords absolutely safe marking of a free flying altitude in its immediate vicinity. In mountainous districts through which the air routes pass, it is important that the beacons should be located at the highest points in the lowest lying ground, where it is possible to establish the air route. Of course, it is necessary in undulating terrain, and where the air route is passing through valleys, to restrict the distance between the beacons, so that the latter are perfectly visible from one another. Changes, of course, in the air route must be marked by a beacon with a perfectly distinctive character of light for its identification, and

changes of route should, as far as ever possible, always be located in direct conjunction with an emergency landing place.

The requisite light power in the white clusters of rays in the beacon can be made dependent upon local conditions at the place where the same is erected, yet at least 1 mill. and at the outside 2 mill. Haeffner lights must be looked upon as necessary, emanating from a distance of 15 miles between beacons. The horizontal spread of the clusters of rays is partly dependent upon the character of light intended for the beacon. The vertical spread amounts as a rule to 4° to 10° with an elevation of about 2°. The size of lamp is mostly 1,000 to 1,500 watt, depending upon the structure and design of the beacons. The periodicity in the intermittent character of the beacon must not exceed 10 seconds. The character of light of the beacons is produced either solely through the source of light or by other sources of light connected up synchronously with the former, thus no dark part in the period of the direction of the air route should exceed 3 seconds. In order to give a light impression fully comprehensible for the human eye, no part of the light in the period must fall below 1/10th of a second.

In order to enable safe identification of a beacon, in view of the possibilities of confusion with other sources of light in its vicinity, or for the purpose of indicating a near-by emergency landing place or change in the direction of the course, etc., coloured lights may be used. Those colours which in this respect have proved to possess the best and greatest signalling effect, are chrome-yellow, red and bluish-green. In virtue of their considerable absorption of light the coloured lights should, however, only be used to such an extent as is absolutely necessary. As warning beacons against obstacles projecting in the terrain, the Neon-light has proved very efficient.

The demands of one to two million Haeffner candle-power in the beacons, as stated by me, are based upon the very latest experiences made in this matter both in America and Germany. The first German night air routes were established on much smaller proportions as to candle power and distance between beacons, but experience has taught us now that the American idea, which almost from the start adopted powerful beacons at comparatively short distance from each other, was the right one.

Atmospheric absorption of light is, unfortunately, such that a directly practicable relation between candle power and distance between beacons can hardly be set up for the practical conditions. We do not attain any material increase in the scope of a beacon by a continuous large increase in the candle power. Nevertheless, the latter should be adapted in such a way that the beacon close to the degree of invisibility in the atmosphere, which in any case forces the pilot to pass over to blind flying, possesses an absolutely safe signalling efficiency for the pilot, *i.e.*, within a radius of at the very least the distance forming the limit value for that daylight vision under which flying with ground orientation should be carried out, viz., about one mile. When flying at an altitude of 300 to 500 metres, and with a distance of about 15 miles between beacons, the pilot in orienting himself from beacon to beacon has in these circumstances always, in steering for the next beacon, a sector approximately at least 8° available for the purpose of getting within the radius of the signalling effect of the beacon for which he is steering.

Crew

The pilot's need of having available for his navigation during the night, meteorological reports, directions, etc., is of such importance that it seems to me absolutely imperative that the crew on board a night mail aeroplane consists of at least two, the pilot and a wireless operator. The wireless operator can preferably be a pilot with a telegraphist's certificate.

Wireless

Already existing and planned wireless stations for air traffic in Central Europe are, maybe, undoubtedly competent to supply information as to position and course for the anticipated night air mail lines. Wireless beacons might to advantage be made use of, particularly along air routes difficult to navigate in mountainous regions, etc. and also for air routes and aerodromes with such a vast amount of traffic that the ground wireless stations concerned are unable to manage the necessary work.

On the larger aeroplanes there may also be fitted with advantage direction finders, by which one will be enabled to determine one's position on board. The wireless beacons erected along the American night air mail routes seem to have a signalling radius of something like 100 to 150 miles.

Meteorological Service

The demands made upon rapid and concise operation of the meteorological services for flying will become keener for the purposes of flying at night. As long as the blind-landing problem remains unsolved, there will be a need at critical moments, *e.g.*, when fog is seen to block the air routes, of continuous, rapid and reliable reports about vision, and a knowledge of wind and cloud altitude conditions at all landing places concerned along the air route. It seems to me, therefore, advisable to consider whether the extremely efficient American system of reporting with automatic telegraph-typewriters should not also be introduced along the bigger night air mail lines in Europe. Every meteorological point of observation should be provided with instruments for measuring the altitude of the clouds and visibility in darkness.

Aeroplanes

I shall now come to, perhaps, the most important factor in the problem of a reliable and economic night air mail service, the most suitable type of machine.

As I have just pointed out, the speed with which mail can be carried is the whole importance of an air mail. Consequently, a claim to speed will be the most insistent demand made upon the right type of aeroplane. A review of the various transport times on the most important long-distance night air mail routes in Europe shows that a cruising speed of between 125 and 140 miles *must* be reached. Furthermore, a mail-carrying aeroplane must have a good load-carrying capacity and a sufficient range.

The load-carrying capacity of the aeroplane for mail becomes naturally different for the different lines, but we may assume that it varies between 1,000 lb. and 3,000 lb. The demand for the radius of action not only depends upon the length of the route to be covered, but also upon general meteorological conditions along the scheduled route, frequency of fogs, etc. While for Swedish conditions we may consider a fuel reserve of 75 per cent. sufficient, the Sabena for its night air mail line between Brussels and London at the present time lays down a fuel reserve of 200 per cent. for the purpose of enabling the pilot—in the event of a particularly troublesome fog on the line Brussels-London shutting off the available landing places—to have a sufficient fuel supply to enable him to continue his flight either until such time as the landing conditions improve or for reaching some more distant station free from fog. When the problem of landing in fog has been solved, such a safety measure will naturally become unnecessary.

To give the performances which are thus required of the night air mail planes it is obvious that several classes of size must be taken into consideration. In doing so we get to the safety view point in so far as concerns the installation of the engine. Single engine or triple engine, that is the question. The demand for high speed speaks in favour of the single-engine installation; safety, on the other hand, points to a triple-engined one. No definite attitude towards this question can be reached unless it is discussed directly in conjunction with the general conditions and circumstances, both relating to weather, terrain and ground organisation, which exists along the air route on which the aeroplane is meant to be employed. A triple-engined aeroplane of to-day with a cruising speed of 110 to 115 miles does not satisfy the demands of night air mail service for speed. For the Scandinavian night air mail service, *i.e.*, on the lines Stockholm-Copenhagen and Oslo-Copenhagen, as well as Copenhagen-Hanover, the following two specially designed types of aeroplanes with a cruising speed of 135 to 140 miles per hour and 75 per cent. fuel reserve, appear to be suitable:—Single-engined, about 600 h.p.; load capacity, mail, 1,000 lb.; triple-engined, about 1,800 h.p.; load capacity, mail, 2,500 lb.

The large type would also permit the carrying of one or two postal officials for sorting the mail on the way.

In addition to the requirements already mentioned, a cruising speed of 135-140 miles, and a loading capacity of 1,000–2,500 lb. respectively, my company has fixed the following important conditions for the air mail planes suitable for the Scandinavian lines:—

(1) Landing speed: 68 m.p.h.
(2) Rate of climb at sea level: 800 ft./min.
(3) Range at cruising speed: 4½ hours, or about 600 miles, corresponding to the longest non-stop flight on the route with a reserve of 75 per cent.
(4) Capacity of mail compartments at least respectively 150 and 500 cu. ft.
(5) To protect the crew in the event of a forced landing, the seats in the one-engined 'plane must be arranged behind and above the mail compartment.

The demand for very great inherent stability in a night air mail 'plane cannot be sufficiently emphasised. It must,

so to speak, be positive, and not merely of the more indifferent nature, as is still the case with so many types of aeroplanes.

Glaciation : The Forming of Ice on Wings and Propellers

Another very serious problem which has become manifest in conjunction with an extension of air traffic even to the dark part of the 24 hours, and throughout the year, is the *risk of glaciation* or coating of ice. The utmost efforts must be made to find a remedy against the unavoidable glaciation of wings and propeller, which takes place when passing through air saturated with moisture or fog with the temperature at about freezing point.

I am afraid I have detained you a very long time over the explanation of what I had to say regarding the possibilities for establishing a regular European night air mail service, for to do so I had to dwell upon both the technical and economical aspects of the subject. In concluding my remarks now I would only express the hope that my hearers have been interested and that I have managed to emphasise sufficiently the importance to other countries of, and the advantages to be gained by, the ultimate co-operation of Great Britain in the organisation and maintenance throughout Europe of a night air mail service such as I have described.

THE DISCUSSION

Mr. Bramson (Director of Aero Syndicate, Ltd.), in opening the discussion, said he felt he was justified in doing so since six or seven years ago he was associated with Capt. Florman and he had therefore first-hand knowledge of his exceptional ability. This ability, he said, was not only confined to matters aerial but also to getting people to do what he wanted them to do, and this was particularly so with governments; in fact, only a day or two ago he had induced the Swedish government to vote 750,000 Swedish crowns as a subsidy to the A.B. Transport Company, and a large part of this subsidy was ear-marked for experiments in "blind" flying.

Baron de Legatineire, of the Aéropostale Company, then gave a short résumé of the work which his company had carried out. He said that although serious troubles were greatly worrying those in charge at the moment, he felt sure that they were mainly of a political nature, and that the line would carry on in spite of these difficulties. The service had, he said, completed 325 trips to South America and back, and they had only lost two lots of mail, while in November and December last year every trip had been completed within seven or eight days. A very large amount of this route was, he said, flown in the dark, and the whole of it therefore had to be equipped for night flying. All the machines used had direction-finding as well as ordinary wireless equipment, and all the pilots were competent to fly at night. The only accidents they had had so far were caused by fog or sand storms. There was a meteorological organisation at every aerodrome, and the pilots were supplied with all available information, such as the most favourable height to fly at having regard to the wind. The machines used were single-engined Latécoère, with 400-h.p. Renault or 600-h.p. Hispano-Suiza, and the top speed was between 130 and 150 m.p.h. The mail was changed over to a different machine at about every six stages, and the organisation for these changes was so laid out that the change could be done very rapidly indeed and thereby cause a minimum of delay.

Mr. Handley Page said they were all very much indebted to Mr. Florman for his paper, which would make them think a great deal. He referred with particular interest to the figures Capt. Florman had shown as an estimate of the cost of carrying all British first-class mail by air, and he said he would like to know whether Capt. Florman could tell them what it would actually cost the transport companies. He referred to the attitude of our own post office which was particularly brought out by Capt. Florman's remarks, and said that although we pay £500,000 subsidy to our air lines, the G.P.O. do not insist upon any air mails being carried. Instead, they appeared to do the reverse. He made mention of the adverse comments which the Postmaster-General was said to have made upon air mail, and suggested that Capt. Florman should tell them some more about this matter. In conclusion, he said he thought it would be interesting to know which portions in Capt. Florman's estimation of the England-India route might be flown over at night.

Mr. Gordon England said he thought that the 140 m.p.h. cruising speed mentioned by the lecturer was hardly sufficient and that it would be better to have 200 m.p.h., a view which was borne out in America. He then asked whether the suggested European network of air mail lines as proposed by Capt. Florman, would carry parcels as well as mail. He also asked whether retractable undercarriages had been considered as being likely to assist in producing high-speed machines.

Lieut. Van den Eynden, night flying pilot on the Sabena night service to London since its inception in April, 1930, said he considered that there were insufficient lights on this side of the Channel. He referred particularly to beacons between Lympne and Croydon which were insufficient, and also to the lack of night landing facilities at Lympne, which was a difficult and somewhat dangerous aerodrome. Incidentally, he said, the same remarks referred to St. Inglevert. The wireless service with Croydon was very good.

Maj. R. H. S. Mealing (Technical Assistant in the Directorate of Civil Aviation), said he had listened with interest to the lighting equipment which Capt. Florman had proposed, and he asked whether Capt. Florman had any idea of the cost of this. His department had worked out in great detail the cost of thoroughly equipping the line between Croydon and Lympne, and had found that it came out at about £1,000 per mile. In conclusion, he said he was able to assure Lieut. Van den Eynden that a floodlight was being installed at Lympne.

Maj. F. M. Green (Armstrong-Siddeley Motors, Ltd.), referred to the assumption which Capt. Florman had made that single-engined machines were necessarily the fastest. He refuted this suggestion, and insisted that a really fast multi-engined machine would have the advantage of being able to fly with one or more engines out of commission. With regard to the pilots themselves, he said he was doubtful as to whether the ordinary civil pilot really understood all about "blind" flying, and he thought that the training in this direction should be of the best.

Mr. Wilcoxson, of Imperial Airways, Ltd., stressed the importance of careful training for blind flying, and said that he felt the future lay in the production of some instrument to fly the machine instead of the pilot under such circumstances, so that the pilot himself was free to check the course and speed.

Mr. L. A. Wingfield (Clerk of the G.A.P.A.N.), said he was interested in the lecturer's remarks that young pilots had proved the best for night flying, because, generally speaking, that was contrary to day flying, where it was found that pilots of long experience were best. He asked for information with regard to the system of training adopted.

Col. the Master of Sempill said that Capt. Florman had dealt with all the most important aspects of air transport, and had shown the utility of a 24-hr. service for mails. He said that as a member of the London Chamber of Commerce, he had first hand knowledge of the unsympathetic attitude of the G.P.O., and the difficulty to be experienced in all dealings with the P.M.G., even such paltry objections as the importance of supplying local postmasters with ¼-oz. weights was the sort of argument put forward against the general adoption and expansion of air mails. Col. Sempill said that they had recently been in close touch with the Air Ministry, and he was able to announce the fact that night-flying with such machines as were available was likely to start in the near future. In conclusion, he referred to his own recent trip in Scandinavia in a "Puss Moth" seaplane and said that we all ought to be grateful to Capt. Florman and especially those who, like himself, had evidence of his vast organisation in that country.

Mr. Fairey made reference to the original version of Capt. Florman's paper where he had quoted remarks by the P.M.G., and said that these remarks, had now been put in a slightly different light and that Capt. Florman himself would deal with the matter.

Capt. Florman, in replying to Mr. Handley Page, said that both his own company and that of the Sabena company were able to run on the rates as laid down by the Hague Convention. He said that he agreed with Mr. Gordon England that 200 m.p.h. would be better than 140 m.p.h., but he thought it best to confine themselves to minimum possibilities. Parcels, he said, were charged at a smaller rate under the Hague Convention, namely, two gold francs instead of six, and would therefore be a profitable cargo. In reply to Maj. Mealing, he agreed that the costs were very high indeed, and he said that the estimated figure to light the route between Stockholm and Malmo would be about 400,000 Swedish crowns, but in defence of this cost he said that the Swedish government were prepared to spend such a sum per mile for a railway to Lapland which was a small country having a population of only 15,000.

AIR SERVICES ACROSS INDIA

IN the course of a debate on an amendment to the Air Estimates in the House of Commons on Tuesday, March 17, Mr. Montague, Under Secretary of State for Air, made the following statement on the position in India, which considerably clears up the situation. Mr. Montague said :—

"I wanted to say something with regard to the question of the Indian service. The matter has been raised, and some amount of doubt has been expressed as to the position. Under the Indian Post Office Act, the sole right of conveyance of mails in India is vested in the Governor-General in Council. The Government of India intend to organise an air service between Karachi and Calcutta for the conveyance of mails, passengers and goods, commencing at the end of this year, on the expiration of the present charter which Imperial Airways have, over the section from Karachi to Delhi.

"That service will run in connection with the Imperial Airways service to Karachi. In view of the probable separation of Burma from India, the Government of India do not propose to extend that Indian State service beyond Calcutta. When the Government of India received proposals for Dutch and French services across India, they were quite prepared to insist that mails should be dropped at the Western port of entry, that is, Karachi, and picked up again at the Eastern port—Calcutta or Rangoon—such mails being sent across India by rail till such time as an Indian State service was prepared to take them across by air. It was upon the urgent representation of His Majesty's Government—this is quite an important point in view of what has been said with regard to the Dutch service across India—who feared, I will not use the word reprisals, but, possibly, unfavourable repercussions by the Dutch or from the French in the Dutch East Indies and French Indo-China and possibly other countries traversed by the England-India air route, the Government of India agreed to allow the Dutch and the French to carry transit mails across India. They are not, however, using either of those services for the transmission of Indian mails.

"In agreeing to this course, the Government of India stipulated clearly that Imperial mail carried by Imperial Airways should be handed over to the Indian State Air Service for conveyance by air from Karachi to Calcutta. A further item of information in this rather important matter is that the Dutch and the French pay the normal rates for housing and landing services within India. Wireless and meteorological services are provided free. No proposal has ever been made to the Government of India that Imperial Airways should be allowed to operate on similar terms to the Dutch and French. It has always been suggested that the Government of India should pay a subsidy to Imperial Airways. In view of pledges given from time to time in the Indian legislative assembly, a subsidy to any company other than an Indian company with rupee capital and a majority of Indian directors is out of the question."

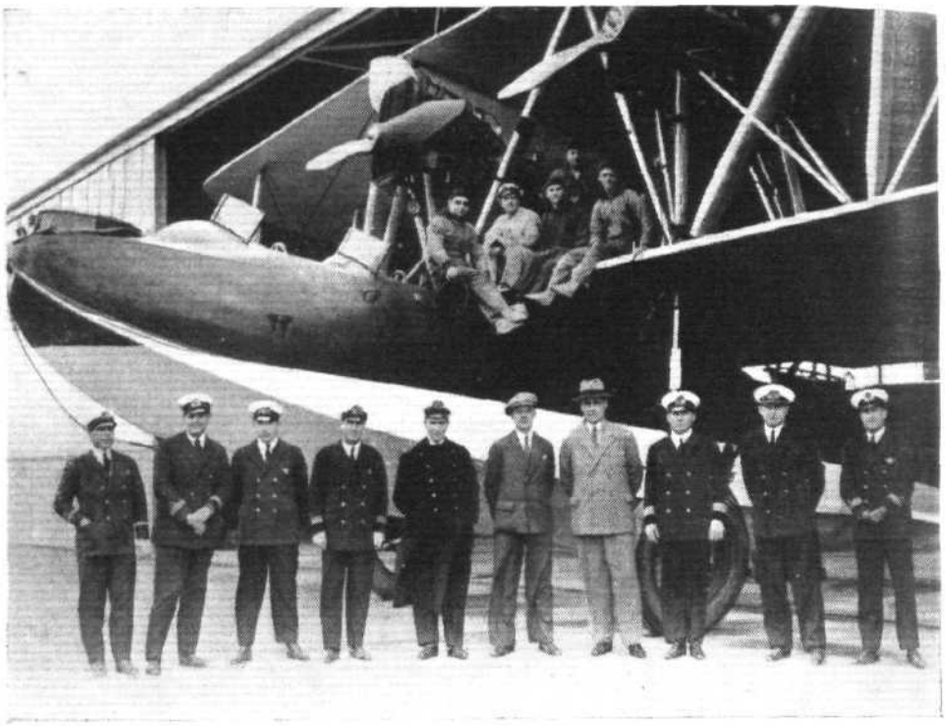
AIRISMS FROM THE FOUR WINDS

The Princes' South American Tour

As briefly recorded last week, the Prince of Wales and Prince George, at the conclusion of the opening of the British Empire Exhibition at Buenos Aires, set out from Palomar, on March 15, in two Puss Moth aeroplanes, to visit Mr. Carlos Brown's famous ranch at Volta. On March 18, the Prince, accompanied by Senora Aguirre and Lord Ednam, left Cordoba by air for Rosario, when a descent was made to refuel. Proceeding shortly after, they arrived back in Buenos Aires in time to attend a dance at the Hurlingham County Club. Prince George returned later by train. On March 21 the Princes said good-bye to Argentina and left Buenos Aires in one of the Supermarine "Southampton" flying-boats of the Argentine Navy for Montevideo, Uruguay. They were accompanied by two other "Southamptons," and reached Montevideo shortly after midday, a tumultuous welcome being accorded them as they landed in the harbour.

Miss Reynolds Held Up

MISS DELPHINE REYNOLDS, who, with Flight-Lieut. W. G. Pudney, is flying a Blackburn "Bluebird" (D.H. "Gipsy III") to the Cape via the West Coast route, has met with a mishap. It appears that her machine was rammed by a river steamer in the Gambra, and the tail and port ailerons were damaged. New parts are being shipped from London.



THE SUPERMARINE "SOUTHAMPTON" IN THE ARGENTINE: On March 21 the Prince of Wales and Prince George flew from Buenos Aires to Montevideo in one of the eight Argentine Navy "Southampton" flying-boats. Our picture shows a group taken on the occasion of the first trial flights with one of these machines at Puerto Belgrano last August and includes, from left to right—the Paymaster and Doctor of the Air Station, Lt. Aumann, Lt. Lepnace (pilot), Comdr. Monti, Mr. B. Powell (Supermarine Aviation Works, Ltd.), Comdr. R. Fitzsimon, Comdr. Jensen (Chief of Air Station), Lt.-Comdr. Cappers, and Lt. Mason Lugones.

Sir John Salmond's Flying Tour

THE two "Iris" flying-boats of No. 209 F.B. Squadron left Mount Batten on March 24, and flew to Hourtin, near Bordeaux. The next stage will be overland to Berre, near Marseilles. Air Chief Marshal Sir John Salmond, Chief of the Air Staff, is leaving London on March 31 by train and steamer for Marseilles, where he will embark on one of the "Iris" boats. The squadron will then make one flight to Malta and another to Sollum, where the C.A.S. will change to a landplane and fly on to Cairo, Palestine, and Transjordan, as was announced in the last issue of FLIGHT. This is the first time that a Chief of the Air Staff has paid an official tour of inspection to R.A.F. stations overseas, though on one occasion, Sir Hugh (now Lord) Trenchard, when visiting Egypt for other purposes, took the occasion to visit the stations. On the outward journey, Sir John will spend two nights at Malta and one at Sollum. The boats are expected back at Mount Batten about April 15.

Paris-Tokio Flight

Two French airmen, MM. Burtin and Moenche, left Le Bourget on March 2, in a Farman 190-Titan monoplane, to fly to Tokio, and reached their destination on March 21. The flight was not without incident, for when they arrived at Seoul, Korea, on March 19, they were detained by the authorities, because they flew over a forbidden area, having taken the Moppo route from Shanghai instead of the Mukden route. However, the airmen were released on March 21, and flew non-stop from Seoul to Tokio, a distance of 12,000 miles. The route followed on this flight was via Syria, Iraq, India, Siam, Indo-China, and China.

Lady Heath Flies Again

LADY HEATH, who is back in America, has been flying again since her accident last year. The U.S. authorities have, however, temporarily withheld her flying licence, because she recently swooped down in her machine to within 20 ft. of some photographers to aid them taking some film pictures of her.

Japanese Airship's 60-Hour Flight

THE Japanese semi-rigid naval airship recently accomplished a flight, without refuelling, lasting 60 hours.

"Graf Zeppelin" to Fly to Palestine

THE German airship *Graf Zeppelin* will make a flight to Egypt and Palestine next month. Permission has been granted for the airship to land at Almaza aerodrome, Cairo, where landing operations will be assisted by the R.A.F. The *Graf Zeppelin* will subsequently fly across the Suez Canal to Palestine and back to Cairo.

W.C.A. Aircraft Destroyed

A FIRE caused by the explosion of a petrol tank has destroyed a hangar and nine machines of Western Canada Airways at Winnipeg. It is estimated that the resultant loss is about £50,000.

Australian Air-liner Missing

ONE of the Australian National Airways Avro 10 machines, *Southern Cloud*, operating on the Sydney-Melbourne service, has been missing since March 21, and up to the time of writing, no news of its fate has come to hand. The air-liner, piloted by Mr. W. T. Shortridge, carried five passengers and a second pilot, and was last seen near Violettown flying low near the Strathbozie Mountains. Severe storms prevailed throughout Victoria at the time, and it is feared the machine has crashed in heavily timbered and inaccessible territory. Although several aircraft have been searching for the *Southern Cloud*, no trace has yet been found. Both Air Commander Kingsford Smith and Mr. Ulm—who formed National Airways Limited—have taken part in the search.

Well-known Italian Pilots Killed

COL. UMBERTO MADDALENA and Capt. Fausto Cecconi, two of Italy's best-known pilots and Engineer-Lt. Giuseppe da Monte lost their lives in a flying accident off Pisa on March 19. It is reported that they were testing a Savoia S. 64, with which an attempt was to be made to regain the duration record—which, until recently, was held by these two pilots—when the machine broke in the air and crashed into the sea. All three took part in the recent formation flight to South America. Messages of sympathy have been sent from the King of Italy, Sig. Mussolini, and Lord Amulree, Secretary of State for Air, sent the following message to General Balbo: "I have heard with deep regret of the tragic accident in which Col. Maddalena, Capt. Cecconi, and Capt. Da Monte

have lost their lives. On behalf of the Air Council and Royal Air Force, I send you my profound sympathy on the irreparable loss which the Regia Aeronautica Italia has suffered by the death of these gallant and distinguished officers."

Canadian Airways Loss

THE first annual meeting of Canadian Airways, Ltd., held recently at Montreal, disclosed a net operating revenue of $1,817,543 (£363,508), with a net loss, after all charges, of $68,704 (£13,740). Nearly 2,000,000 miles were flown by eastern and western aeroplanes. The weight of mail matter carried was 333,913 lb. and other freight brought the total to 835,352 lb. Canadian Airways, Ltd., was formed last autumn by a merger of the leading air lines.

The Cie. Générale Aéropostale

IN our leading article last week we gave a brief historical résumé of the activities of the Cie. Générale Aéropostale, in the course of which we stated that " more than one account has been published by travellers which mention the old types of aeroplane used on parts of this route, and the discomforts thereof." We also gave the excuse for the past policy of the line which was put forward by the advocates of the company—namely, that France had to get ahead or be left behind. We did not intend to imply that the company still continued to use machines of a war-time vintage on its main services, and we are aware that only up-to-date types are now in use on the company's line from France to South America. In our issue of April 11, 1930, a full account of the activities and the fleet of this company was published, which, we think, did full justice to its enterprise and efficiency. Meanwhile, it is gratifying to note that the company still has a chance to carry on, for, while the French Senate rejected the plan of reorganisation voted by the Chamber on March 20, the motion for a simple credit of £48,000 was passed when the Premier suggested this step in order to prevent the company closing down forthwith.

Night Flying on the India Route

NEXT month (actually on April 11), Imperial Airways will inaugurate regular night flying between Baghdad and Basra, on the route to India. This will shorten the schedule time of the journey to Karachi from six and a half days to five and a half days. The aerodromes at Baghdad and Basra have already been equipped with lighting apparatus for night landings. The distance from Baghdad to Basra is 300 miles, and the pilots will rely on directional wireless and on their compasses to keep on the direct route. They will not follow the windings of the river, but when they are above it they will probably be able to see the water and lights on the banks. If this experiment proves a success, the section from Cairo to Gaza may next be flown by night. This should be an easier section, as, after crossing the Suez Canal, most of the route follows the line of the coast. It is not proposed to fly the whole of the desert route by night in the immediate future. This would imply setting up beacon lights at intervals, and the desert is not a place where valuable property can be left without sufficient guard against hostile or mischievous Bedouins.

Combined Rail and Air Parcels Service

AN arrangement has been made between the railway companies and Imperial Airways, Limited, by means of which urgent freight and parcels addressed to a destination on any air route operated by Imperial Airways may be handed in at certain railway stations and forwarded at an inclusive freight charge. A similar joint air and railway service will operate in the reverse direction, goods being accepted by Imperial Airways at any point on their routes for through transit to railway stations in the United Kingdom. The arrangement will apply to about 140 centres in Great Britain at which it will be possible on and from April 1 to hand in a parcel for transit by express train to London and thence by air freighter to any of the air stations of Imperial Airways on the Continent and along the main or mail routes to such places as Egypt, Iraq, India, and Central and Southern Africa, or *vice versa*. The scale of rail and air freight rates chargeable will be in accordance with the published figures. Full particulars can be obtained at all the principal railway stations in the country and from Imperial Airways, Limited.

Grant for Civil Aviation in Free State Estimates

IN the estimates for the Public Services, 1931-32, for the Irish Free State an item is included under the heading " Assistance to Civil Aviation," £10. Our Irish correspondent learns that the item was not included as a practical joke, but as a " token " vote to enable the Minister of Industry and Commerce to introduce a supplementary vote if necessary during the year. We wonder if this is a good omen, perhaps the Free State Government has at last awakened to the fact that it is at least ten years behind the " flying " times.

Air Survey in Tanganyika

A BILL has been sanctioned by the Tanganyika Legislature providing for a loan of £2,850,000 to cover development works, including railways, roads, harbours, automatic telephones, tsetse fly research, and air surveys.

Segrave Trophy

THE Awarding Committee for the Segrave Memorial Trophy, meeting at the Royal Automobile Club on March 19, decided that the trophy be awarded to Wing-Commander C. E. Kingsford-Smith, in consideration of his Atlantic flight—the second East to West flight—and his record England-Australia flight. The trophy is awarded to the British subject who, in the judgment of the Awarding Committee, accomplishes the most outstanding demonstration of the possibilities of transport by land, air, or water.

Stroke of " Mercury " Engines.

WE have been asked by Captain Andrew Swan to point out that in his tables of aero engines, published in *The Aircraft Engineer* of February 27, 1931, on page 15, the stroke of the Bristol " Mercury " engines series, V, VI, VII, and VIII, should be 7·5 inch, and *not* 6·5 inch. Will readers who wish to have their copies accurate please make the necessary corrections. The only " Mercury " with 6·5 inch stroke is the series IV A.

Dinner to Dr. W. Hoff

THE Lecture given by Dr. W. Hoff before the Royal Aeronautical Society on March 19, on " Research work in the Deutsche Versuchsanstalt fur Luftfahrt," was followed by a dinner in honour of the lecturer, given by the President of the Royal Aeronautical Society, Mr. C. R. Fairey. Among those present were: Dr. Seydel, Dr. Van Scherpenberg, Secretary of the German Embassy. Colonel the Master of Sempill, Immediate Past-President of the R.Ae. Society, Mr. H. E. Wimperis, Director of Scientific Research, Sir Richard Glazebrook, Chairman of the Aeronautical Research Committee, Professor R. V. Southwell, Mr. F. G. T. Dawson, Mr. F. Handley Page, Major T. M. Barlow, Dr. G. V. Lachmann, Major A. R. Low, Mr. C. C. Walker, Mr. M. L. Bramson.

Aerial Mapping in Canada

NEARLY 4,000,000 acres of land were mapped from the air in Northern and Western Canada during the last year.

ON TEST AT FELIXSTOWE: The Avro Trainer, type 621 S, has now been fitted with floats, and has just passed very successfully its preliminary tests at Hamble. The machine has now gone to Felixstowe for official tests. The engine is an Armstrong Siddeley " Lynx IV C."

THE AIR ESTIMATES

Mr. Montague's Speech in the House of Commons

INTRODUCING the Air Estimates in the House of Commons, on March 17, Mr. F. Montague, M.P., Under Secretary of State for Air, said :—

"The estimated expenditure for 1931 shows a net total of £18,100,000, which is an increase of £250,000 upon the current year's figure. There is a somewhat larger rise in the gross estimate than in the net, the figure of the gross increase being £273,400. This is accounted for by an increase in Appropriations-in-Aid of £23,400, but, as the Appropriations-in-Aid include the provision of the necessary funds for a British entry in the Schneider Trophy Contest this year, it is evident that there would otherwise have been a decline under this item. Hon. Members will realise that gross estimates form the most accurate standard of comparison if we are considering national expenditure upon Air Services from one year to another, and upon this basis our air expenditure is substantially lower today than it was six years ago.

"Only by the most rigid economy consistent with efficient administration of the Service has it been possible to keep the figures of estimated expenditure as low as those I have given.

"The rise of a quarter of a million pounds actually conceals a considerable measure of economy over the whole field of air expenditure. All concerned have given unremitted attention to the need for effecting savings wherever possible without endangering safety or reducing efficiency. The increase is one of very small dimensions considering the addition that has become due to be made to the strength of the Air Force.

"When the scheme for Home Defence was promulgated in June, 1923, it was estimated that an additional average cost would have to be imposed upon air estimates of no less than £5,500,000. The gross air estimates for that year amounted to £18,600,000 so that, if this additional expenditure had been entailed, it would have meant a gross figure of not just over £21,000,000, but of £24,000,000.

"This is not, of course, the whole picture. The Home Defence scheme has been slowed down from time to time, and consequently it has been possible to spread the capital outlay over a longer period. But any reduction thus achieved in the annual expenditure under this head has been far more than offset by additional commitments in other directions. Thus, since 1923, in addition to progress on the Home Defence scheme, a number of new formations have been brought into being for naval and military co-operation and other purposes. The annual cost of these new formations may be put at about £1,500,000 per annum. This figure, added to the cost of the Home Defence scheme as originally estimated and communicated to Parliament at the time, viz., £5,500,000 as above stated, makes a total of £7,000,000 *new* expenditure on items for which no provision had to be made in 1923. Yet these Estimates are only £2,500,000 gross in excess of those for 1923, and actually lower than they were in 1925. These figures will give Hon. Members some measure of the savings which have been secured. Of course, the process has been helped by extraneous factors such as reductions in the garrison of Iraq and the smaller provision made for airships in these Estimates, as well as by the fall in prices. Otherwise the result would have been impossible. But in the main it has only been achieved, as my Noble Friend has pointed out in his memorandum accompanying the Estimates, by the exercise of the most rigid economy on the part of all concerned, and the continuous review of establishments both at home and abroad.

"In the forthcoming financial year, three further squadrons will be provided for Home Defence in accordance with the scheme on which the Air Ministry has been working by very gradual stages for some years past.

"I would remind the House that, when the scheme for the air defence of this country was first authorised in 1923 (and it has since been re-affirmed by successive Governments), it was contemplated that a force of 52 squadrons would have been completed by 1930. We are now in 1931. In the past financial year, one Cadre squadron has been added, bringing the Home Defence Force to date up to 39 squadrons, comprising 452 aircraft. But it should be remembered that 13 of those 39 squadrons exist upon a non-regular or a Cadre basis. Eight of them belong to the Auxiliary Air Force, and the entire personnel—except for a small number of regular personnel and the instructional staff—is composed of officers and men who, like those of the Territorial Army, would only be called out for service in the event of a major war. This also applies to a substantial proportion of the personnel serving in the five Cadre squadrons. When the three new squadrons have been added, we shall have 42 squadrons with an approximate first-line strength of about 490 aircraft, only two-thirds of which, however, as I have said, will belong to the units of the regular Air Force. In other words, in 1931, there will be 10 squadrons fewer than the original scheme authorised for completion by 1930.

"Reasons for the slower progress are well-known to the House, and the policy has been justified by successive Governments upon the ground that a major war was a remote possibility. The increase proposed this year was foreshadowed a year ago, and this continuity of policy is in no way inconsistent with those efforts towards International understanding in which this nation has played its important part.

"I have no desire to strike a note of alarm, in referring to First Line strengths of other countries, but rather to emphasise the point that this country, whilst it insists upon maintaining a Force of high quality and technical efficiency of the first order, has no desire—even if it were otherwise practicable—to indulge in a race of air armaments, but looks for substantial results to that international understanding which every friend of humanity and progress hopes will be the outcome of the Disarmament Conference. It is a fact, however, that this country stands fifth, as regards first-line strength, among the Air Powers of the world. Moreover, in our case, our smaller strength is much more widely distributed and has to bear a much bigger responsibility for air defence abroad.

"Whilst it is difficult to give exact figures, owing to varying methods of budgetary presentation, it is clear that, whereas British air expenditure may be said to be roughly 1 per cent. lower than in 1925-6, there has been a remarkable rise in air expenditure abroad. Thus, French expenditure is up by between 130 per cent. and 140 per cent., Italian by, roughly, 40 per cent., and that in the United States by between 150 per cent. and 160 per cent.

"In addition, in some countries the figures have been still further increased by extra-budgetary grants, whilst it must be noted that the United States figures are for federal expenditure only.

"Constant efforts are being made to improve the Air Force in aircraft design and fighting efficiency, and it will be interesting to the House to know that the only two types still designated as being of "wartime design" —although very considerably modified since their inception—are the D.H.9A. and the Bristol Fighter. There are now no D.H.9A.'s in squadrons. The Bristol Fighter will still arm No. 6 Squadron, Middle East, but only until the squadron is re-armed on the 1931 programme. The same statement applies to two regular squadrons in India and, in addition, there are two squadrons in India whose 1930 programme of re-armament will not be complete until June, 1931, when substitution of this type will take place. Thus, by the completion of the 1931 programme, the Bristol Fighter—as well as the D.H.9A.—will have disappeared from squadrons.

"More modern machines, which will be brought into service as rapidly as possible, include the 'Fury' Interceptor—an aircraft designed primarily for the defence of London, and one which has a very high rate of climb. The standard fighter for all purposes is the 'Bulldog,' to which the 'Siskin' is now obsolescent. A naval edition of the land 'Fury' aircraft is the 'Nimrod,' which has a speed of about 60 m.p.h. more than the present type, and a new fighter reconnaissance aircraft for naval purposes is the 'Osprey,' which is a suitable adaptation for naval purposes of a new day-bombing machine called the 'Hart,' which has a better all-round performance than any previous aircraft of this class. I may add here that a number of General Purpose IIIF. machines are being introduced into service this year with air-cooled engines.

"Four years ago, the change from wood to metal aircraft construction was inaugurated and this year no wooden aircraft are ordered for squadrons and only a small number ordered of composite construction. Excluding training and subsidiary units, there are at the present moment only 12½ per cent. of wooden aircraft, and these will, before very long, be wholly replaced by all-metal machines.

"The term 'all-metal' does not, of course, apply to wing fabric, although research has been instituted to ascertain the possibilities and value of metal skin over wings. Technical developments in all-metal construction during 1930 have mainly been practical improvements with a view to simplifying repair and maintenance of aircraft. It is a remarkable fact which indicates the advantages of this system of construction that the life of all-metal airframes is, upon the average, double that of the wooden airframe of 1927. Practically, every firm is now equipped for manufacture in metal and the transition from wood to metal has been almost completed in the short period of four years.

"The Royal Air Force has been engaged during the past year in arduous operations, involving long hours of flying carried out under exceptionally difficult conditions.

"The serious risings that occurred last year on the North-West Frontier of India, called for aircraft action, and there is no doubt that, if aircraft had not been available, ground operations on a much larger scale than actually took place would have been inevitable.

"It is unnecessary for me to give a recital of these operations and, indeed, that would more properly fall to the Department which is politically responsible. But I would like, in view of possible later discussion, to say just this—this country is at present responsible for the defence of India; defence, if undertaken at all, must be efficient or inefficient, carried out by the most humane methods or by less humane methods, but, in any case, the alternative to the defence of Indian villages and citizens from attacking tribes, would not be peace, but the sword. It is not a question of the Constitution of India; an Indian Government, of whatever kind of construction, would have to defend the North-West Frontier, or leave that area at least to forces of anarchy. I hope that, in any discussion upon this point, the real situation will be borne clearly in mind. If it is a question of humanity or inhumanity, there can be no doubt that, in these border operations, the air is far less an agent of slaughter than any other medium of warfare.

"It may interest Hon. Members to know that, during these operations, the Royal Air Force carried out a total of 1,153 aircraft attacks, flew a total of 5,530 hours and in no case did a forced landing take place in enemy territory. These figures reflect the greatest credit upon the officers and men of the squadrons concerned.

"An experiment in provisioning a military force during operations on the frontier is worth recalling; 1,400 men and 850 animals, moving up from Dargai, were kept in food supplies dropped from the air during the first two days of their march. Three tons of supplies of ration and forage were dropped daily by 14 aircraft—'Wapiti' aircraft, using a recently-designed supply-dropping device—each machine carrying several parachute loads, weighing up to 56 lb., and making four journeys daily from the Base.

"Squadrons of the Home Defence Force were subjected to severe tests in August by intensive warlike exercises. It is true that the attack was to a great extent able to penetrate the defence, but, it must be remembered that the modern types of bombing machine were opposed by older types of defensive aircraft. There seems no doubt, however, that air attack, however stoutly resisted, must inflict enormous damage and loss.

"I would like this year to make special reference to the valuable support which the Department is receiving from the Aeronautical Research Committee, the Universities of Oxford and Cambridge—at which, as the House is no doubt aware, we have air squadrons in addition—and from the other Universities and places of education and research which have undertaken important and arduous work upon the many problems relating to aeronautics.

"The main channel through which we receive assistance from the scientific world is the Aeronautical Research Committee, which succeeded the pre-war Advisory Committee for Aeronautics and was set up just 11 years ago to assist the Secretary of State. Since reconstruction into its present form in 1925, it has consisted entirely of scientists working in the Government Laboratories and in the Universities. Members of the House have, from time to time, had opportunity of seeing examples of the assistance which it is always ready to render on occasion, but they may not fully appreciate the mass of work undertaken by the Committee and its various sub-Committees. It deals with the scientific investigation of accidents, with problems of aerodynamics, air transport, aircraft noise, phenomena, such as flutter and spinning, the elasticity and fatigue of metals, wing structure and many other fundamental lines of research. It is through this Committee with its sub-Committees and Panels that the Air Ministry is able to maintain constant touch with various groups of independent scientific workers at the Universities and elsewhere; the result is that there is always a large group of the most eminent scientific men—who are acquainted with the problems of present-day aeronautics—upon whom the Air Ministry is able to draw when special problems of urgency or importance arise. The assistance rendered by these experts to the Ministry, and to the science of aeronautics generally is of inestimable value.

"A considerable amount of important research is also undertaken at the Royal Aircraft Establishment, Farnborough, and, if I select one or two lines of development for illustration purposes, it will only be by way of indicating —far from exhaustively—the nature of the work done there.

"The scientific staff and pilots attached to the Royal Aircraft Establishment have been experimenting with one of the most difficult and, at the same time, important problems of air navigation. This is the question of landing in fog and the particular experiment that I have in mind is that of fixing the approximate position of an aerodrome by means of a captive

balloon let up above a fog bank. Once this approximate position is determined, the pilot is able to reach the ground by means of indicating instruments upon the machine. The experiments have been carried out with great skill and determination under novel and difficult conditions, and it is hoped that the knowledge that has been gained will be of value in increasing the safety of flight under adverse weather conditions.

"Another problem, affecting civil aviation principally, and of importance to passengers in transport aircraft, is that of noise. Experiments begun last year have been actively continued. Comparisons have, for instance, been made with two similar machines, one having geared and the other ungeared engines, with a view to discovering which type is the quieter, and in investigations of this character noise is measured with an instrument called the audiometer, in which a unit of measurement is used which is the smallest difference of strength between two sounds that can be perceived by the human ear. Tests have been proceeding on engine silencers in order to reduce the noise of exhausts, and there has been made a sound-proof cabinet, in which different materials are being tested to show ways in which the noise in the cabins of air liners can be reduced by having suitable sound-proof walls.

"One of the most important problems in the research programme is undoubtedly that of spinning. The present position is that although the main factors responsible for the behaviour of an aircraft in a spin are known, there is not yet sufficient knowledge of the aerodynamic forces involved to justify any certain prediction whether a design will prove satisfactory in this respect.

"A possible method of attacking this problem is to have a miniature wind tunnel which gives a vertical flow of air, and in this a model aircraft can be so placed that, if the controls are properly set, it should continue to spin in the up-draught in approximately the same place in the tunnel, enabling photographs and measurements to be taken of it. Much more accurate results are anticipated by this method than could possibly be obtained from the few spins that a model can give before reaching the ground after being liberated from the top of an aircraft shed—a method of study that has hitherto been adopted. The use of such a tunnel is now under consideration.

"The High Speed Flight during the past year has been engaged on research work in connection with the efficiency of airscrews. A large quantity of scientific information has also been obtained from the machines themselves. The House will appreciate that, when these machines were built at the time of the 1929 Schneider Trophy Race, a considerable amount of information was obtained from scale models in the wind tunnels, but there was no time fully to measure the actual characteristics of the machines themselves at full scale. All we know was that we won the Race at a certain measured speed. Since then we have been finding out what the actual aerodynamic characteristics of the machines are, and, when these data are fully analysed, they will provide a valuable comparison with the results that were previously obtained from scale models.

"These, as I have said, are a number of what may be described as the more interesting subjects which have been under examination, and in connection with which satisfactory progress has been made in the past year. Whilst I am speaking upon the question of safety, I would like to give the House some account of what is done as a matter of Air Ministry practice in the direction of engineering reliability of manufacture and general control of inspection, particularly with regard to civil aviation. This is a subject which will be recognised as of great importance, in view of the development of air transport in the future. I would say quite definitely that accidents attributable to faulty workmanship or incorrect manufacturing processes are now of the very rarest occurrence.

"Inspection starts with the raw material and is carried out in one unbroken chain until the complete aircraft is ready for its trial flight. There is a complete chain of record and of responsibility from start to finish.

"I have personally seen the A.I.D. system at work and I can speak for its efficiency. Whether it is a question of measurement, torsional strength, elasticity or metallic fault, no test could be applied throughout the work of greater reliability than is the case under this system. I am not able to speak in technical terms or with any great knowledge of physical science, but many illustrations occur to me of a striking character which bear out what I say. One that comes to my mind is the detection of a fine crack in a test-piece of metal which I saw in one engineering shop. Not even a microscopical examination revealed the flaw, but the piece of metal was magnetized and then plunged into a bath of paraffin oil containing iron dust in suspension. Any crack in the metal—however small—formed a gap in the magnetic field and was clearly disclosed by the way in which the iron dust adhered to the metal.

"A system has been evolved under which Inspection staffs of firms are first of all approved, and I may mention here, as an example of the number of inspectors required, that five Sheffield firms producing steel of aeronautical quality employ today solely on the inspection of that work more than 150 men. No firm is approved or allowed to take its place in any category—whether in the manufacture of basic material, of detail parts or of standardised equipment and supplies, or of assembling the complete engine and aircraft—until it has proved to the Aeronautical Inspection Department that its own inspection department is properly equipped and organised, and, therefore, fully qualified to carry out the necessary inspection at each stage. But, in addition to this approval of inspection staffs, an effective overhead system of supervision is organised by the Ministry, and its effectiveness is such that it can be fairly claimed that the control at any approved firm's works is as good as could be secured if all the firms' inspectors were actually direct employees of the Ministry.

"The general outline of the procedure is that firms desiring to supply aircraft or aeronautical material of any kind must first apply for and obtain approval of its inspection organisation. The firm's name is then added to the list of approved firms, from which buyers may select the firm whom they ask to quote for supplies. Every firm's name is allotted to one of the area offices of the Aeronautical Inspection Department, and the A.I.D. staff of that office becomes responsible for the supervision of the firm's inspection, making systematic visits, re-inspecting a proportion of output, checking inspection records and satisfying themselves generally as to the competency of new personnel or organisation.

"Inspection of aero engines is carried out in the same way, and aircraft and engines for the Royal Air Force are finally examined and tested by A.I.D. representatives. An A.I.D. officer and a number of junior ranks are actually resident at each of the aircraft and aero engine maker's works.

"This elaborate system of inspection which has been developed has fully proved its worth. Combined with the high quality of British aircraft workmanship, it puts the British aircraft industry in a paramount position.

"I can assure the House that no less regard is paid to the care and supervision of aircraft within the service. The commanding officer of the unit is primarily responsible for the maintenance of all technical equipment; airmen are responsible to him for correctness of the maintenance of the aircraft to which they are allocated.

"There is a maintenance schedule kept in every hangar detailing the times at which various operations are to be carried out. This system I have seen in actual operation, as well as the method of the daily duty sheet, upon which is written the names of persons responsible for carrying out particular work.

"The House will be interested to know that of the 35 types of aircraft at present in service, 15 are now fitted with automatic slots and four other types are on the point of completion. Slots are being tried out experimentally with flying boats and high performance aircraft of the single seater fighting type, and, under a recent decision, training aircraft now make use of slots. Taking the proportion of machines so fitted, 80 per cent. of the service is either equipped or on the point of equipment with slotted aircraft. In addition, as another important measure of safety, a parachute is available for every officer and man in the air, and by the end of this year all types of aircraft in the service will have been designed or modified to permit of their carriage and use. Ths applies, of course, to the Fleet Air Arm and the possibility of doing this for sea-going aircraft is due to the success of the new quick-release gear.

"I come now to another important branch of Air Ministry work, namely, to civil aviation. It is a matter for congratulation that within the last few days 2,675 miles of the 5,700-mile air route from Cairo to Cape Town has been opened. Before the end of the year, the whole of the route will be in operation. Between Cairo and Cape Town there are 27 stations and this work, together with the development of meteorological and other services, has been a remarkable achievement reflecting credit upon everyone concerned. There are hotels, resthouses and wireless stations, many in areas which until recently were rough bush.

"As an example of the difficulties that have had to be overcome, I may mention that where aerodromes have been laid down in the higher altitudes along the line of the journey, the comparative rarity of the air reduces the commercial load of an aeroplane, so that the cost of operation is seriously increased. But for all the difficulties, there is high hope of the success of the venture and of great subsidiary development in the future.

"The South African service, now partly an achievement, will, it is hoped, be ultimately linked by feeder lines, bringing into air communication with the central air line many enormous and wealthy territories.

"In connection with this service and the service to India, which are both fed by the service from London to Egypt, I am very happy to announce that the terms of a draft Anglo-Italian Convention have now been agreed between representatives of the two countries. Under the terms of this convention, Imperial Airways are granted permission to operate with land 'planes via Milan, Rimini and Brindisi.

"For a period of one year, Imperial Airways are also permitted to resume operation of the Genoa-Naples-Corfu route with seaplanes, and the permission may be extended for a further period of twelve months.

"In return, an Italian company nominated by the Italian Government, may operate services to the United Kingdom, Gibraltar, Malta, Cyprus or Aden. The Convention requires ratification, but it is proposed that it will remain in force for 10 years; pending ratification the services can be operated by agreement.

"The draft of an Anglo-Greek Air Convention has also been agreed between representatives of the two countries, which will permit of operation by Imperial Airways either by the Italy-Corfu-Athens-Alexandria route or by the Mid-Europe route through Salonica to Athens.

"It is expected, assuming that the London-Egypt service reverts to the Italian route, that the journey between London and Cape Town will ultimately take 10½ days.

"A tentative scheme has been prepared for a weekly air mail service between Calcutta and Australia to link up with the existing passenger and mail service between England and India. The scheme has been worked out on the assumption that the stage between Karachi and Calcutta will be operated as an Indian State Service in conjunction with Imperial Airways, Ltd. These proposals are now under consideration by the Governments concerned.

"The position with regard to the proposed British air services in the West Indies and between the West Indies and Canada is not in as complete a state as we should like to see. The original proposals which I explained to the House last year have now, in view of financial difficulties, been divided into two sections, the first covering West Indian Islands and penetrating into British Guiana, and the second a weekly service between Trinidad and Montreal by way of Bermuda. The present scheme depends upon the co-operation of Canada in view of their interest in the second section of the project; negotiations are proceeding and it is hoped that a practical result will ensue.

"The past year has seen the end of the 1924 Airship programme. The R.100 completed her acceptance trials on returning from Canada on August 16, and the R.101 set out on the flight to India—which was to have completed her acceptance trials—on October 4. It will, of course, be understood that, until there has been time for the report of the Simon Court upon the accident to R.101 to be considered by the Government, any attempt to discuss future airship policy would be premature.

"This is not the occasion to say anything of an emotional character in connection with the terrible accident to R.101. The nation was inexpressibly affected and those of us who were closely associated with the airship venture and the personnel involved realise that our own poignant feelings could not be put into words, but I cannot let this opportunity pass without saying how much the sympathy, not only of the country in which the accident occurred, but, indeed, the whole world, has been appreciated. With regard to the French people, that sympathy was added to by the wonderful helpfulness and kindness shown in connection with all the sad arrangements that had to be made.

"When the airship left for India the total staff of the Royal Airship Works amounted to 861. I am sorry to say that the immediate result of the accident was to stop all work connected with that airship, and steps were taken to minimise expenditure which might prove nugatory in the light of possible changes in airship policy. This inevitably meant reductions in staff at Cardington, but, in order to mitigate hardship, it was decided to allocate to the Royal Airship Works certain items of work which normally would have gone elsewhere. Until a Cabinet decision is given, airship work at Cardington will continue on the minimum basis consistent with maintaining an effective staff, and the provision made in these Estimates will not cover future development work in respect of which supplementary provision would be required.

"I have endeavoured to cover the main features accounted for by the Estimates presented to the House and to give Hon Members some idea of what is happening under Air Ministry control and supervision. Any further particulars that it is in my power to give to the House, I shall be happy to give.

"I think that it will be agreed that, in view of the natural growth of such a young service as the Royal Air Force, and having regard to considerations of efficiency in national defence and the demands of the great and really vital modern enterprise in civil aviation which must be encouraged—especially at this stage—in every possible way by the nation, the slightly increased estimate which I have had the honour to present to the House will be found to be fully justified."

THE DEBATE ON AIR ESTIMATES

THE debate was appropriately opened by Sir Samuel Hoare, who desired to call attention to what appeared to be a very serious leakage of official information. On that very day they found in the *Daily Herald* a detailed account of what the report on the R 101 disaster was supposed to contain. He suggested that the matter should be placed in the

hands of the Law Officers. He congratulated the Under Secretary on continuing the programme of air development, military and civil, which he found when he went to the Ministry. He said that since 1923, when the first start was made with the Home Defence programme, the speed of bombers had risen by 30 per cent., their ceiling had reached nearly 30,000 ft., and their bomb sights, once notoriously inaccurate, had now made air bombing as accurate as naval gunnery was in 1914. The newest type of fighter had a speed of over 200 m.p.h. and could climb to 15,000 ft. in little more than seven minutes.

With one exception, the great countries had been increasing their air expenditure. The exception was the United Kingdom. Since 1923 we had reduced ours by 1 per cent. During that period, the expenditure of France had risen by 139 per cent., that of the U.S.A. by 159 per cent., and that of Italy by 40 per cent. These facts seemed to show that the sanctions and guarantees of the covenant and the Kellog Pact were not considered sufficiently effective to be regarded as substitutes for national defence. In this age of mobility international pacts might perhaps guarantee ultimate victory, but they could not ensure immunity from almost instantaneous attack. After eight years we still had only 42 out of the 52 squadrons that were required for Home Defence, and no fewer than 13 of these were non-regular. Of first line machines, France had 1,320, Italy, 1,100; Russia, 1,000; U.S.A., 1,050; and Great Britain, 790. Our attitude at Geneva should be definitely in favour of the control and reduction of air armaments. The question of an air agreement was even more urgent than the naval question.

The Marquess of Clydesdale, in a maiden speech, regretted that the Estimates did not provide for any increase in the Auxiliary Air Force, and urged the claims of Scotland for more recognition from the Air Ministry.

Mr. Hore-Belisha said that we ought to spend more money on the peaceful and commercial purposes of aircraft. The charge of civil aviation should be handed over to the Board of Trade.

Capt. Harold Balfour said that the control of the Air Ministry over the Fleet Air Arm should be strengthened. He asserted that some R.A.F. pilots were overworked, especially at a certain flying training school (Grantham was later mentioned) where they had to fly on Saturday afternoons and Sundays to get through their work. There was a line of connection between accidents and tired brains, which had not yet been made, and he hoped it never would be made. Turning to civil flying, he said that we had made a wrong start, by carrying passengers to Paris and India. He urged a service which carried mails first and goods second. We should follow the example of our continental rivals and develop night air mails. He also suggested a subsidy for the gliding movement.

Admiral Sueter asked if anything had been done to develop Malta as a seaplane base so that flying boats could land there in safety. He urged the formation of an engineer branch in the Royal Air Force.

Sir Philip Sassoon said that Auxiliary squadrons should be preferred to Cadre squadrons, because there was a corporate spirit about the former which was absent from the latter. The Cadre squadron fell between two schools. The regular element was too large to permit of a corps spirit among the civilian elements, while it was not large enough to permit of a spirit comparable to that of a regular squadron. He asked what arrangements had been made for continuing the arrangement with Persia, which permits us to use the Persian Gulf aerodromes.

In the course of his reply to the debate, Mr. Montague said that the report on the R 101 disaster had not been received by the Air Ministry, and so there could have been no leakage from that quarter. As for overwork, he said that apart from fluctuations caused by weather, the work of a flying training school followed a regular syllabus, and that special care was taken to see that flying instructors were not employed too long on that somewhat exacting duty. The expense of a breakwater at Malta was an impossible amount to consider.

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Howard Lectures

DR. N. A. V. PIERCY, Head of the Department of Aeronautics at East London College (University of London), will deliver three Howard Lectures at the Royal Society of Arts, John Street, Adelphi, during April, all lectures beginning at 8 p.m. The dates are: April 13, 20, and 27. The general title of Dr. Piercy's lectures is "The Present Position in Aeronautics," and in the first lecture he will deal with "The Scientific Outlook," in the second with "Safety in the Air," and in the third with "Air Travel and Private Flying." The lectures will be illustrated by lantern slides and models. Admission is by ticket only, and application should be made to the Secretary of the Royal Society of Arts.

Another Paper by Mr. Gouge

IT will be recollected that, early in January of this year, Mr. A. Gouge, general manager of Short Brothers, read before the Royal Aeronautical Society, a paper entitled "Some Aspects of the Design of Sea-going Aircraft." On March 24 Mr. Gouge read another very interesting paper, "The Design and Construction of Flying Boats," this time before the Institution of Engineers and Shipbuilders in Scotland. The two papers by Mr. Gouge have little in common, and in the latest paper, he is obviously addressing himself to naval architects who have not made a specialised study of the peculiar conditions appertaining to marine aircraft. The result is that, even to those who are familiar with land aircraft design, the paper contains much that is of very great interest, while others will find the paper a most excellent introduction to the study of marine aircraft design. The first part of the paper deals with such subjects as hydrodynamic design, *i.e.*, water resistance during take-off, angle of hull during run, moments required to trim, and longitudinal stability at high speeds. Next follows a section on aerodynamic design, which will be familiar to all who have studied land aircraft design. The section dealing with "tail volume" will provide average formulæ for those who are not conversant with the "tail volumes" used in successful flying boats. The section dealing with structural design gives an outline of the local stresses encountered and the assumptions made in cases where the stresses are not definitely known. The general construction of the air frame is also dealt with at considerable length, and altogether the paper is a very good introduction to the subject of marine aircraft, and more particularly, flying boat design.

Recent Castrol Achievements

WE are informed that on the occasion of the recent record flight of the two French airmen, Bossoutrot and Rossi, who established new duration and distance records on their Bleriot 110 monoplane, Wakefield's "Castrol" was used. Incidentally, "Castrol" secured another success in the first automobile records of the season at Brooklands on March 13, when Mr. G. E. T. Eyston established new international records in Class H (750 c.c.) for the mile and kilometre on Mr. J. A. Palmer's supercharged M.G. Midget.

For Motoring Readers

WE have just received a copy of "Duckham's Map and Guide," a really useful and well-produced booklet for motorists. In addition to containing 16 pages of exceptionally clearly-printed maps of England, Wales and Southern Scotland, showing the principal roads, this booklet—which measures 5½ by 8½ in.—also contains much information concerning lubrication and lubricating oils, including a section devoted to aero engines. As may be gathered from the title, it is produced by Alexander Duckham and Co., Ltd., of Duckham House, 16, Cannon Street, London, E.C. 4, who will be pleased to send a copy, free, to any of our readers who care to apply at the above address.

The Annual Flying Number of the "Bystander"

THE *Bystander* will be issuing their annual flying number on April 15. This is the fourth year of issue, and if one is to judge by the standard of previous years, it should be exceptionally interesting. Col. Sempill will be writing about Gliding, Capt. H. H. Balfour on Flying from the Private Owner's point of view, and Mrs. Victor Bruce will give some more details of her great flight. The *Bystander* is the only illustrated weekly of its type which has annually devoted additional space over and above its usual weekly page to aviation.

Transporting Aviation Fuel

THE safe running of our aircraft engines depends to a very large extent upon the provision of suitable fuel and the majority of the large companies now keep a special department to deal with the supply of aviation fuel. The Anglo-American Oil Co. of course run their own fleet of tankers for bringing the crude oil from many parts of the world to this country, where it is refined into the various grades of petrol and residue oils in one of the companies' large refiners, such as that at Fawley, near Southampton. These tankers are costly to maintain in as much as the centre portion which consists of the tanks for holding the oil has to be ballasted with salt water on the journey out and this necessitates cleaning out with steam and the change from oil to salt water gives rise to very virulent corrosion. This corrosion constitutes a matter which has to be dealt with frequently. Up to recently it has been customary to repair the tanks wherever possible, and eventually to scrap the vessels when they got too bad, which unfortunately invariably occurred before the machinery or other parts of the ship were anything like worn out. Mr. H. A. Wilson who looks after this part of the Anglo-American Co. together with their naval architect, Mr. H. C. T. Bryant, recently had a brain wave which enabled their vessels to continue trading and making profit while preparations were made for renovating them. They instructed the well-known ship firm of Palmers S. B. & I. Co., Ltd., to construct a complete new middle portion containing the tanks for one of their vessels, namely the *Cadillac*, while she was still making trips to the oil fields and back. When the centre portion was ready, the *Cadillac* was brought into dock, cut into three pieces, and temporary bulkheads rigged at each end of the three portions. The bow was then floated out with the old middle portion after it, and the new middle portion was then floated in, ballasted down on to the chocks and lined up in correct position between the stern portion and the bow which had followed it. Then the whole was joined up again. This operation only took seven weeks altogether from the time the vessel was docked until the time she steamed away on her next voyage in a renovated condition thereby effecting a vast saving of time and cost. The main details of this extraordinarily interesting engineering feat were exhibited in the form of a film recently shown at the Gaumont Demonstration Theatre, and Mr. E. L. Champness, Assistant General Manager of Palmers explained the whole matter very thoroughly; since the *Cadillac* was so successful, a second ship, the *Saranac*, has also been operated upon.

THE ROYAL AIR FORCE

London Gazette, March 17, 1931

General Duties Branch

C. H. Schofield is granted a short service commn. as Flight Lieut. with effect from Mar. 1, and with seny. Aug. 25, 1930. The following Pilot Officers are promoted to rank of Flying Officer:—G. Silyn-Roberts (July 11, 1930); I. A. Critchley (Dec. 28, 1930); W. I. H. Burke, Lord M. A. Douglas-Hamilton (Jan. 27); J. L. C. Banks, A. W. B. Page, R. L. West (Feb. 15); K. M. Cass, L. A. Cubitt, G. G. Dixon, H. de M. Middleton, J. B. Tatnall (Feb. 28). Flight Lt. F. R. Wynne, M.B.E., is placed on half-pay, scale B., Feb. 14 to Mar. 12 inc. (substituted for *Gazette*, Feb. 17). The following Flying Officers are transfd. to Reserve (Mar. 13):—Class A.—J. W. Duggan, H. P. Hudson, N. McLeod, N. C. Ross-Roberts, G. A. V. Tyson, E. F. Wain. Class C.—R. A. Barnett, S. R. Sherman. The following Flight Lts. relinquished short service commns. on completion of service (Mar. 15):—W. F. Humphery, M. E. B. P. Storrie, G. N. P. Stringer, D.F.C. (Lt., R.W. Kent Regt., R.A.R.O.).

Medical Branch

The following Flight Lts. are granted perm. commns. in this rank (Mar. 18):—C. Crowley, M.B., B.Ch., G. W. McAleer, M.B., Ch.B., A. E. Vawser, L.M.S.S.A.

RESERVE OF AIR FORCE OFFICERS

General Duties Branch

Flight Lt. G. N. P. Stringer, D.F.C. (Lt., R.W. Kent Regt., R.A.R.O.), is granted a commn. in this rank in Class A, on relinquishing short service commn (Mar. 15); Flying Officer B. Martin resigns his commn. on appointment to Royal Canadian Air Force Reserve (Feb. 2). The following relinquished their commns. on completion of service:—Flight Lt. J. M. McEntegart (Oct. 24, 1930); Flying Officer H. P. Morris (Nov. 13, 1930); Flying Officer F. S. Henderson (Nov. 27, 1930); Flying Officer F. H. Bugge (Dec. 5, 1930); Flying Officer A. W. Daly (Dec. 9, 1930); Flying Officer W. A. C. A. Yearsley (Dec. 29, 1930); Flying Officer G. M. Trundle (Jan. 3); Flying Officer A. H. C. Derby (Mar. 9).

AUXILIARY AIR FORCE

General Duties Branch

No. 608 (North Riding) (Bomber) Squadron.—The following to be Pilot Officers: G. H. Ambler, J. L. Clayton (Feb. 7); A. N. Wilson (Feb. 10).

ROYAL AIR FORCE INTELLIGENCE

Appointments.—The following appointments in the Royal Air Force are notified:—

General Duties Branch

Group Captain T. G. Hetherington, C.B.E., to H.Q., Coastal Area, pending posting to Special Duty List, 23.2.31.

Wing Commanders: A. Shekleton, D.S.O., to H.Q., R.A.F., Halton, for Engineer duties; 7.3.31. R. S. Maxwell, M.C., D.F.C., A.F.C., to No. 23 Group, H.Q., Grantham, pending posting to R.A.F. Practice Camp, North Coates Fitties; 7.3.31.

Wing Commanders: E. L. Tomkinson, D.S.O., A.F.C., to R.A.F. Practice Camp, Catfoss, to command, 12.3.31. K. C. Buss, O.B.E., to R.A.F. Practice Camp, Sutton Bridge, to command, 12.3.31. R. S. Maxwell, M.C., D.F.C., A.F.C., to R.A.F. Practice Camp, North Coates Fitties, to command, 12.3.31. J. O. Archer, C.B.E., to Air Ministry (D.P.S.) for Personnel Staff duties, 16.3.31.

Squadron Leaders: B. A. Malet, D.F.C., to R.A.F. Base, Gosport; 5.3.31. C. Porri, to R.A.F. Depot, Uxbridge; 10.2.31. T. F. W. Thompson, D.F.C., to Central Flying School, Wittering; 9.3.31.

Squadron Leaders: A. Durston, A.F.C. to R.A.F. Base, Calshot, 9.3.31. J. H. Green to R.A.F. M.T. Depot, Shrewsbury, 13.3.31.

Flight-Lieutenants: C. D. Pyne, to Home Aircraft Depot, Henlow, 2.3.31; A. W. Symington, M.C., to H.Q., Coastal Area, 9.2.31; G. R. Ashton, to Armament & Gunnery School, Eastchurch, 9.2.31; H. W. Clayton, to Station Administration, Halton, 1.3.21; D. R. W. Thompson, to Electrical & Wireless School, Cranwell, 3.3.31; G. S. White, to Experimental Section, Royal Aircraft Estab., S. Farnborough, 9.2.31. G. L. Gandy, to No. 1 Air Defence Group H.Q., 5.3.31; V. F. Whatling, D.S.M., to No. 10 Group H.Q., Lee-on-Solent, 23.2.31. S. C. Strafford, D.F.C., to H.Q., R.A.F., Transjordan and Palestine, Jerusalem, 18.2.31; V. P. Feather, to No. 1 Air Defence Group H.Q., 7.3.31; W. H. Golder, D.S.M., to H.Q., Fighting Area, Uxbridge, 7.3.31; J. E. L. Drabble, to Station H.Q., Upper Heyford, 7.3.31; W. Badley, to No. 3 Flying Training School, Grantham, 21.2.31.

Flight Lieutenants: G. Hallawell, to R.A.F. Depot, Uxbridge; 12.2.31. L. B. Duggan, to R.A.F. Depot, Uxbridge; 18.2.31. A. D. H. Foster, to R.A.F. Depot, Uxbridge; 19.1.31. C. H. Schofield, to Central Flying School, Wittering, on appointment to a short-service commn.; 1.3.31. V. Croome, to R.A.F. Base, Singapore; 5.3.31. P. V. Williams, to No. 2 Flying Training School, Digby; 5.3.31.

Flight Lieutenants: C. Hallawell, to Central Flying School, Wittering, 9.3.31. E. C. de V. Lart, to R.A.F. Depot, Uxbridge, 7.2.31. G. S. Shaw, to School of Photography, S. Farnborough, 16.3.31. W. M. M. Hurley, R. V. M. Odbert, J. H. Hutchinson, all to R.A.F. Depot, Uxbridge, 22.2.31. C. F. Chinery to Home Aircraft Depot, Henlow, 13.3.31. N. S. Paynter, to H.Q., R.A.F., Halton, 11.3.31. A. A. C. Hyde, to Station H.Q., Upavon, 10.3.31. F. R. Wynne, M.B.E., to No. 1 (Indian Wing) Station, Kohat, 13.3.31. R. H. Barlow, to R.A.F. Depot, Uxbridge, 17.2.31. W. H. Merton, to No. 2 (Indian Wing) Station, Risalpur, 13.3.31.

Flying Officers: R. R. Bennett, to Night Flying Flight, Biggin Hill, 1.3.31; W. N. Blain, J. Marson, R. J. P. Morris, all to Armament & Gunnery School, Eastchurch, 3.3.31.

Flying Officers: M. M. Restell-Little, to Home Aircraft Depot, Henlow; 4.2.31. B. G. Farrow, to R.A.F. Depot, Uxbridge; 7.2.31.

Flying Officers: N. F. V. Henkel, to R.A.F. Depot, Uxbridge, 6.2.31. J. Addison, to Home Aircraft Depot, Henlow, 1.3.31.

Pilot Officer: R. V. McIntyre, to No. 447 Flight, 26.2.31.

Pilot Officers: W. E. Rankin, to R.A.F. Depot, Uxbridge, on appointment to a short-service commn.; 2.3.31. A. C. D. Webb, to R.A.F. Depot, Uxbridge, on appointment to a short-service commn.; 5.3.31. The undermentioned are posted to the units indicated, with effect from 8.3.31:—L. H. Anderson, to No. 2 Sqdn., Manston. P. E. Hudson, R. G. Wilde, both to No. 4 Sqdn., S. Farnborough. T. B. Cooper, to No. 13 Sqdn., Netheravon. J. C. F. Peacock, to No. 16 Sqdn., Old Sarum. W. A. A. Ashcroft, to No. 26 Sqdn., Catterick. B. J. McGinn, to No. 1 Sqdn., Tangmere. W. E. L. Lewis, R. C. Parker, both to No. 3 Sqdn., Upavon. W. Halmshaw, D. M. T. Macdonald, both to No. 7 Sqdn., Worthy Down. P. H. Maxwell, A. W. Vincent, both to No. 17 Sqdn., Upavon. A. P. Glenny, W. A. Richardson, both to No. 23 Sqdn., Kenley. H. St. G. Burke, N. Daunt, both to No. 25 Sqdn., Hawkinge. W. R. Sadler, J. C. W. Staveley, both to No. 29 Sqdn., North Weald. R. I. G. MacDougall, R. T. S. Morris, both to No. 43 Sqdn., Tangmere. G. E. W. Parish, W. A. J. Satchell, both to No. 54 Sqdn., Hornchurch. T. J. MacDermot, to No. 99 Sqdn., Upper Heyford. H. A. Simmons, to No. 111 Sqdn., Hornchurch.

Pilot Officers: R. M. Smith, to No. 14 Sqdn., Amman, Palestine, 24.2.31. J. B. T. Whitehead, to No. 47 Sqdn., Khartoum, 25.2.31. R. V. Alexander, to No. 84 Sqdn., Shaibah, Iraq, 20.2.31. B. E. Lowe, to No. 55 Sqdn., Hinaidi, Iraq, 20.2.31. T. J. MacInerney to No. 1 Armoured Car Company, Hinaidi, Iraq, 20.2.31. W. E. Rankin, to No. 12 Sqdn., Andover, 16.3.31.

Stores Branch

Squadron Leader P. J. Murphy, to Station H.Q., North Weald; 7.3.31.

Flight Lieutenants: H. T. H. Copeland to Central Supply Depot, Hinaidi, Iraq; 16.2.31. E. A. Tottle, to No. 1 Stores Depot, Kidbrooke; 7.3.31.

Flight Lieutenant L. Smith, to R.A.F. Depot, Uxbridge, 7.2.31. C. T. Davis, to No. 1 (Indian) Group H.Q., Peshawar, 13.3.31.

Flying Officers: J. F. Young, M.M., to No. 4 Stores Depot, Ruislip; 7.3.31. R. B. Brown, to No. 504 Sqdn., Nottingham; 7.3.31.

Flying Officers: R. M. Thomas, to R.A.F. Depot, Aboukir, 23.2.31. C. J. Cousins, to R.A.F. Depot, Uxbridge, 22.2.31. C. L. Thompson to Aircraft Depot, Karachi, India, 13.3.31.

Medical Branch

Group Captain H. W. Scott, to R.A.F. Depot, Uxbridge, on transfer to Home Estab., 20.2.31.

Wing Commander: H. B. Porteous, to H.Q., R.A.F., Cranwell, pending posting for duty as Principal Medical Officer, 7.3.31.

Wing Commander T. S. Rippon, O.B.E., to R.A.F. Depot, Uxbridge, on transfer to Home Estabt., 20.2.31.

Squadron Leader B. F. Haythornthwaite, to Aeroplane and Armament Experimental Estab., Martlesham Heath; 12.3.31.

Squadron Leader J. R. Crolius, to No. 4 Flying Training School, Abu Sueir, 10.2.31.

Flight-Lieutenants: C. Crowley, to Palestine General Hospital, Sarafand, 7.2.31; B. B. Kennedy, to No. 14 Sqdn., Amman, Palestine, 4.2.31; G. W. Paton, to Princess Mary's R.A.F. Hospital, Halton, 7.3.31; F. E. Lipscomb, to R.A.F. Hospital, Cranwell, 7.3.31; J. H. Cullinan, to Armament & Gunnery School, Eastchurch, 9.3.31.

Flight Lieutenant J. Parry-Evans, to Princess Mary's R.A.F. Hospital, Halton, 16.3.31.

Flight Lieutenant H. W. Corner, to Central Medical Estab.; 11.3.31.

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The Royal Air Force Memorial Fund.

The first meeting of the current year of the Executive Committee of the above Fund was held at Iddesleigh House, on March 11. In the absence of the chairman, Sir Charles McLeod, Bart, the chair was taken by the deputy chairman, Dame Helen Gwynne-Vaughan, G.B.E.

After the usual financial resolutions the committee proceeded to pass the accounts for the year 1930 as audited by the Fund's accountants, Messrs. Barton, Mayhew & Co., Alderman's House, Bishopsgate, E.C., and further approved of the issue of the annual report, which for the first time, was drawn up by a sub-committee appointed for that purpose. The report has been considerably abridged as regards its volume and it is hoped will prove more useful in its smaller form.

Since the last meeting of the executive committee held on December 10, 1930, and up to and including March 10, 1931, the grants sub-committee have sanctioned the issue of grants in aid of relief of all kinds to the amount of £3,312 14*s.* 1*d.*

It was reported that the school supported and administered by the fund, namely, Vanburgh Castle School, Blackheath, S.E.3, opened for the current term on January 9 last with an attendance of 39 boys.

The committee received with very great regret, a letter from the late chairman of the executive committee, Lord Hugh Cecil P.C., M.P., who felt compelled to offer his resignation of membership of the committee by reason of his inability to attend meetings, chiefly owing to his ill-health, and his resignation was accepted by the Committee with very great regret. In the meantime Lord Hugh Cecil retains both the post of vice-president and the important post of a trustee of the fund.

Air Commodore B. C. H. Drew, C.M.G., was invited to become a member of the executive committee.

The usual meeting of the Grants Sub-Committee of the Fund was held at Iddesleigh House on March 5. Mr. W. S. Field was in the chair, and the other members of the committee present were Mrs. L. M. K. Pratt-Barlow, Air Commodore B. C. H. Drew, Sqdn.-Ldr. A. H. Wann. The committee considered in all 16 cases, and made grants to the amount of £401 4*s.* 7*d.*

⁂ ⁂ ⁂ ⁂

W.R.A.F. Reunion Dinner

The eighth annual reunion dinner of the Women's Royal Air Force will be held at the Florence Restaurant on April 11. Dame Helen Gwynne-Vaughan, president of the W.R.A.F. Old Comrades' Association, will be in the chair. The guests will include Air Marshal Sir Robert Brooke-Popham, Commandant of the Imperial Defence College, Air Commodore B. C. H. Drew, and representatives of the Comrades of the Royal Air Forces and of the Old Comrades' Associations of the Q.M.A.A.C. and of the W.R.N.S.

Army Staff College, Camberley

The undermentioned officer has completed satisfactorily the course at the Staff College, Camberley, which terminated in December, 1930: Wing-Commander E. B. Beauman, p.s.a.

Specialist Armament Course

The undermentioned officers are entitled to the symbol "A," having successfully completed the Specialist Armament Course at the Armament and Gunnery School, Eastchurch, terminating on January 31, 1931:—Flight-Lieut. C. M. Heard, Flight-Lieut. E. D. MacL. Hopkins. Flying Officer T. M. Abraham, Flying Officer H. D. Spreckley.

AIRCRAFT COMPANIES' STOCKS AND SHARES

THERE has been a distinctly stronger tendency in the stock and share markets during the month in respect to the issues of companies associated with the aircraft industry. De Havilland ordinary shares have made quite a good recovery presumably on the prospect of the company benefiting from the publicity arising from the Argentine exhibition and the use of the company's machines by the Prince of Wales. Handley Page participating preference shares have come into strong demand, and it is reported in the market that buying of the shares has come recently from very influential quarters. The report and accounts are due shortly and there are said to be favourable developments impending although whether these relate to an increase in the dividend or to other matters is not clear. On the basis of a repetition of last year's dividend and bonus the shares give an attractive yield. D. Napier & Son is another ordinary share which has risen sharply in price following the issue of the accounts showing high earnings and an excellent financial position. There is stated to have been a line of shares from a deceased estate on the market, and that this was the cause of the low price recently ruling. As this line has now been virtually absorbed, the price of the shares has responded and the market is anticipating a further recovery to over 10*s.* per share. Fairey Aviation ordinary shares maintain a very even price at beteeen 12*s.* and 13*s.*, and purchasers are apparently content to await the ultimate benefits attaching to the high equity value of these shares. Rolls-Royce were steady on maintenance of the 10 per cent. dividend. Hoffman Manufacturing preference shares were adjusted to the reduced margin of profit but the ordinary shares have not been " marked " since the issue of the report and passing of the dividend. Brown Brothers were a shade up following the accounts showing maintenance of profits with a repetition of the 10 per cent. dividend.

Name.	Class.	Nominal Amount of Share.	Last Annual Dividend.	Current Week's Quotation.
			%	
Anglo-American Oil	Deb.	Stk.	5½	99⅛
Armstrong Siddeley Develop. ..	Cum. Pref.	£1	6½	16/3
Birmingham Aluminium Castg.	Ord.	£1	7½	20/3
Booth (James), 1915	Ord.	£1	15	42/9
Do. do.	Cum. Pref.	£1	7	22/6
British Aluminium	Ord.	£1	10	30/6
Do. do.	Cum. Pref.	£1	6	21/–
British Celanese	Ord.	10/–	Nil	7/7½
British Oxygen	Ord.	£1	10	19/9
Do. do.	Cum. Pref.	£1	A	21/3
British Piston Ring	Ord.	£1	22½	30/–
British Thomson-Houston ..	Cum. Pref.	£1	7	23/4½
Brown Brothers	Ord.	£1	10	24/9
Do. do.	Cum. Pref.	£1	7½	23/6
Dick (W. B.)	Cum. Pref.	£10	5	5⅞
De Havilland Aircraft ..	Ord.	£1	5	19/7½
Dunlop Rubber	Ord.	6/8	15	12/6
Do. do.	"C" Cum. Pref.	16/–	10	20/9
En-Tout-Cas (Syston) ..	Def. Ord.	1/–	Nil	1/4½
Do. do. ..	Ptg. Pfd. Ord.	5/–	8	4/4⅓
Fairey Aviation	Ord.	10/–	7*	12/7½
Do. do.	1st. Mt. Deb.	Stk.	8	106
Firth (Thomas) & Sons ..	Cum. Pref.	£1	6	11/– xd
Do. do. ..	Cum. Pref.	£1	5*	11/9 xd
Ford Motor (England) ..	Ord.	£1	10	77/6 xd
Fox (Samuel)	Mt. Ptual. Deb.	Stk.	5	72½
Goodyear Tyre & Rubber ..	Deb.	Stk.	6½	100¼
Handley Page	Ptg. Pref.	8/–	12½	11/4½
Hoffmann Manufacturing ..	Ord.	£1	Nil	22/6
Do. do. ..	Cum. Pref.	£1	7½	16/–
Imperial Airways	Ord.	£1	5	16/6
Kayser, Ellison	Ord.	£5	6	60/–
Do. do.	Cum. Pref.	£5	6	77/6
Lucas (Joseph)	Ord.	£1	25	67/9
Napier (D.), & Son	Ord.	5/–	15	8/9
Do. do.	Cum. Pref.	£1	7½	23/6
Do. do.	Pref.	£1	8	22/–
National Flying Services ..	Ord.	2/–	Nil	–/6
Petters	Ord.	£1	7	21/6
Do.	Cum. Pref.	£1	7½	17/10½
Roe (A. V.) (Cont. by Armstrong Siddeley Devel., *q.v.*)	Ord.	£1	—	—
Rolls-Royce	Ord.	£1	10	35/–
Smith (S.) & Sons (M.A.) ..	Def. Ord.	1/–	18¾	2/1⅛
Do. do.	Ptg. Pfd. Ord.	£1	12½	19/6
Do. do. ..	Cum. Pref.	£1	7½	17/3
Serck Radiators	Ord.	£1	17½	37/–
" Shell " Transport & Trading	Ord.	£1	25*	66/10½
Do. do. ..	Cum. Pref.	£10	5	10½
Triplex Safety Glass	Ord.	£1	5	29/10½
Vickers	Ord.	6/8	8	8/3
Do.	Cum. Pref.	£1	5*	18/3 xd
Vickers Aviation (Cont. by Vickers, *q.v.*)	—	—	—	—
Westland Aircraft (Branch of Petters, *q.v.*)	—	—	—	—
Whitehall Electric Investmts.	Cum. Pref.	£1	7½	25/9 xd

A Issued in January. * Dividend paid tax free.

IN PARLIAMENT

Schneider Trophy

LIEUT.-COMMANDER KENWORTHY, on March 18, asked the Under-Secretary of State for Air what is the estimated total cost of British participation in the forthcoming Schneider trophy race; what proportion of this is money which would otherwise have to be found from public funds; and what was the cost falling on public funds in 1929?

Mr. Montague: Preparations for a Schneider Trophy contest interact very closely with the official programme of research and development in high-speed aircraft and engines, and it is very difficult, particularly at this stage, to give any satisfactory estimate of the total cost, direct and indirect. I may say, however, that the expenditure which would not have been incurred but for the decision to participate, is estimated at approximately £100,000. I may add that the original cost to public funds of the machines and engines purchased in connection with the 1929 contest, which will also be utilised in connection with the 1931 contest, was about £230,000, but this includes the cost which cannot be precisely determined, of the normal programme of high-speed research and development over the period affected. I do not think any other money will have to be raised by private funds outside Lady Houston's generous gift.

PUBLICATIONS RECEIVED

Das Segelflugzeug. By Dr.-Ing. W. v. Langsdorff. J. F. Lehmanns, Munich. Price M.9 and M.10.

Aeronautical Research Committee Reports and Memoranda. No. 1341 (Ae. 473, T. 2971). *The Motions, at the Stall, of a Bristol Fighter Aeroplane with Slot and Aileron Control on Both Planes.* By K. W. Clark, B.Sc. May, 1930. Price 9*d.* net. *No.* 1343 (Ae. 475, T. 2995). *The Automatic Timing of Aircraft over a Speed Course.* By J. K. Hardy and K. V. Wright. February, 1930. Price 1*s.* net. *No.* 1352 (Ae. 483, T. 2983). *Movement of Smoke in the Boundary Layer of an Aerofoil Without and With Slot.* By T. Tanner. July 1930. Price 1*s.* net. *No.* 1354 (Ae, 485, T. 2810). *Lift and Drag of Blackburn "Iris."* By L. P. Coombes and R. K. Cushing. May, 1929. Price 6*d.* net. H.M. Stationery Office, London, W.C.2.

NEW COMPANIES REGISTERED

PETERS ENGINES AND AIRCRAFT, LTD.—Capital £5,000, in 4,000 10 per cent. cumulative preference shares of £1 each and 20,000 ordinary shares of 1*s.* each. Under agreement with J. A. Peters. Manufacturers and repairers of engines, aeroplanes and flying machines, motor cars and vehicles, etc. Subscribers: J. A. Peters, 30, Caldecote Street, Newport Pagnell, engineer. J. Foster, 27, Old Bond Street, W.1, merchant.

AIRSPEED, LTD.—Capital £50,000 in £1 shares. Manufacturers of and dealers in aircraft of all kinds, motors, engines, apparatus, machinery, component parts, etc. Directors:—Lord Grimthorpe, Easthorpe Hall, Malton, Yorks. Sir Alan J. Cobham, Grand Buildings, Trafalgar Square, W.C.2, aviation consultant. A. E. Hewitt, 6, Lendal, York, solicitor. N. S. Norway, 5, St. Leonards, York, aeronautical engineer. A. H. Tiltman, "Hillway," Ditchling, Sussex, aeronautical engineer. Solicitor: A. E. Hewitt, 6, Lendal, York.

AERONAUTICAL PATENT SPECIFICATIONS

(*Abbreviations*: Cyl. = cylinder; i.c. = internal combustion; m. = motors. The numbers in brackets are those under which the Specification will be printed and abridged, etc.)

APPLIED FOR IN 1929

Published March 26, 1931

38,636. GENERAL DEVELOPMENT CO. Aeroplane. (344,101).

APPLIED FOR IN 1930

Published March 26, 1931.

6,683. H. CORBISHLEY. Phonograph motor wind-indicating device. (344,219.)

12,667. J. FURST. Glider kite. (344,275.)

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